Vol. 2 TECHNOLOGY DEPARTMENT JUNE, 1920 No. 3

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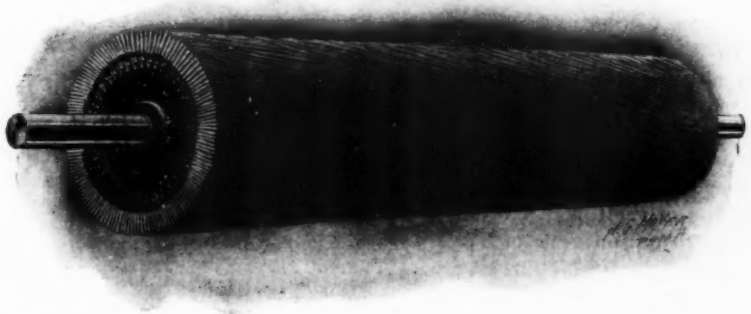

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Vol. 2—No. 3

THE PAPER INDUSTRY

A. SCOTT DOWD
Editor

A MONTHLY EDUCATIONAL JOURNAL
Devoted to the Interests of The Paper Industry

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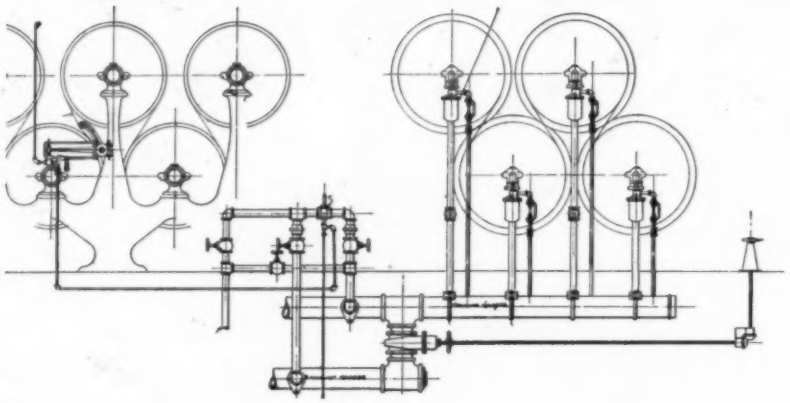

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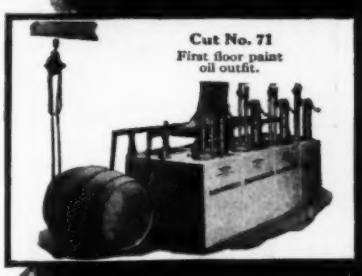
Cut No. 224 Portable tank for lubricating oil.



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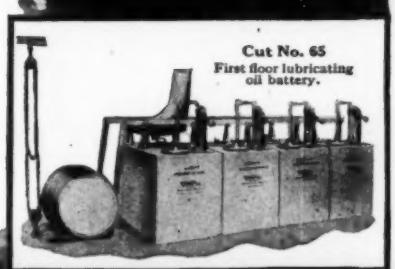

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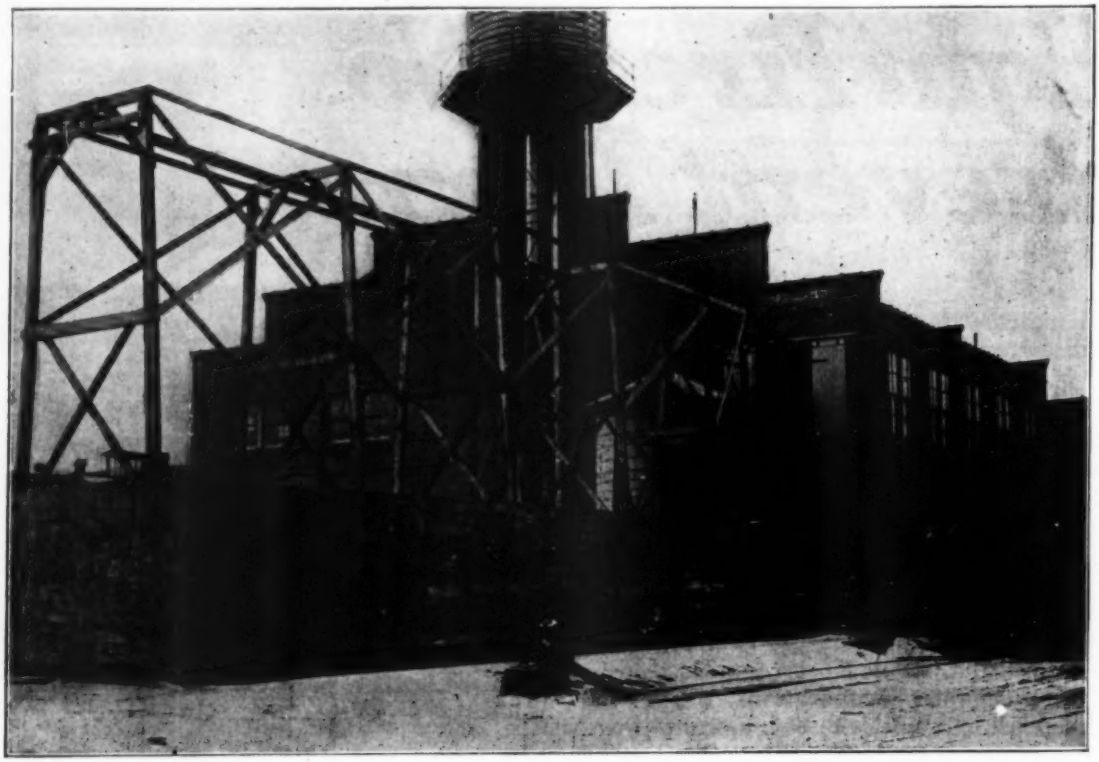

Typical Godfrey Installation showing one-ton Bucket travelling on track and carrying coal into Boiler House

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119 Thirteenth Street **Elkhart, Indiana**

EDITORIAL

Coal Storage or Coal Shortage?

EVER since this publication was started, we have from time to time pointed out to paper and pulp manufacturers the great need of coal storage, in order that the mills might be able to run throughout the winter season without the usual troubles of shut downs and constant worries from shortage of coal.

Long before the paper was started, the publisher talked to paper manufacturers of the great need for this move, and was happy to find that some of them did take this advice, while others have continued in the same old way from year to year, and as the winter season comes around, they have seen the folly of it, but with the spring, the subject is forgotten until it is again too late.

Some years ago, we visited a large plant and found the president growing gray over the non-arrival of some cars of coal, which were then somewhere on the tracks between the mine and his mill, and he said that unless they arrived that day they would have to shut down. The mill was full of orders at a high price, but they did have to close down for some days. We told him what we thought about this subject and advised him to put in coal storage the first thing in the spring, and he thought this was good advice. But the next winter, about the same time, we happened to call on him again, and found exactly the same conditions prevailing. Even yet this big plant has no coal storage except to put piles in the yard on the ground.

Another plant we have in mind put in a large concrete basin which holds about 8,000 tons, bought a locomotive crane, and when cars do not come in as ordered or expected, they dip from the basin what they need and go ahead, and we believe pay for the whole outfit in savings every year, aside from the saving of that which is more important, that of worry over not having coal, or fearing it will not arrive on time.

This is an important question for paper manufacturers, but NOW is the time to go ahead and get ready for next winter. There are many different firms making different kinds of devices for the storage and handling of coal, many of them advertised in this issue, and the thing to do is to take it up with some of them, or devise some plan of your own, but don't put it off until too late to be of service for the coming winter. We all know what happened to coal last winter. Let us hope conditions will be better this coming season, but the outlook at this time does not indicate that conditions will be any better than for some years past, and with the present conditions of the railroads, you may have more trouble in getting coal next winter than you did last year, and if so, this means the closing down of many plants, just at a time when you are liable to be full of orders, and this you cannot afford to have happen.

"Procrastination is the thief of time," said some bright mind, but it not only means the loss of time, but means the loss of considerable revenue, the worry over closedowns, over not getting out orders on time, making your customers sore, and you cannot afford to have any of these things happen. So go to it NOW.

To Our Customers and Friends:

In these times of stress when it seems impossible to fill orders as quickly as you would sometimes wish, we want you all to know that every effort is being made to serve you to the best of our ability, and that every ounce of our strength is being exerted with that thought in view—namely, to serve—so that you may always have on hand sufficient of the wires that are noted for their long runs, and which always make good our claim that

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Appleton, Wis.

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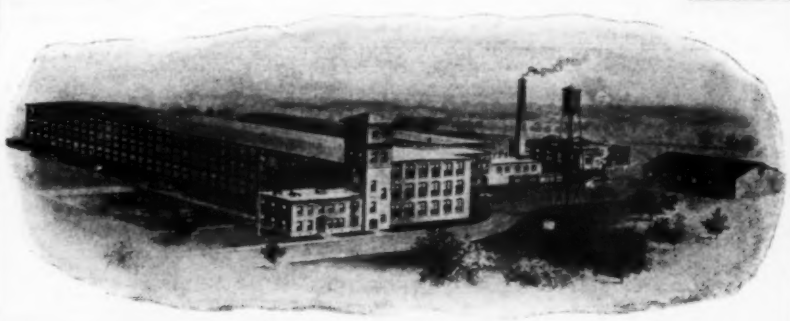
ALBANY FELTS are adapted for every type of Paper and Pulp Machine, and for every kind of stock. Every one is made of Pure Wool of the very best quality.

¶ Twenty-five years' experience in making Paper Makers Felts and Jackets has shown us how to make them as best suited to the needs of various kinds of machines and stock.

¶ Every possible effort is made to give our customers the best satisfaction and to weave into our Felts and Jackets the longest possible life.



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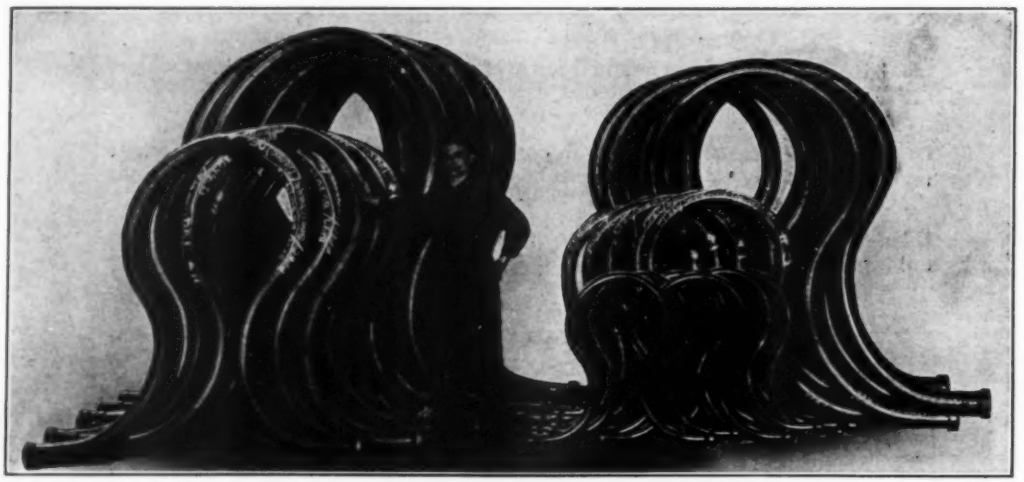

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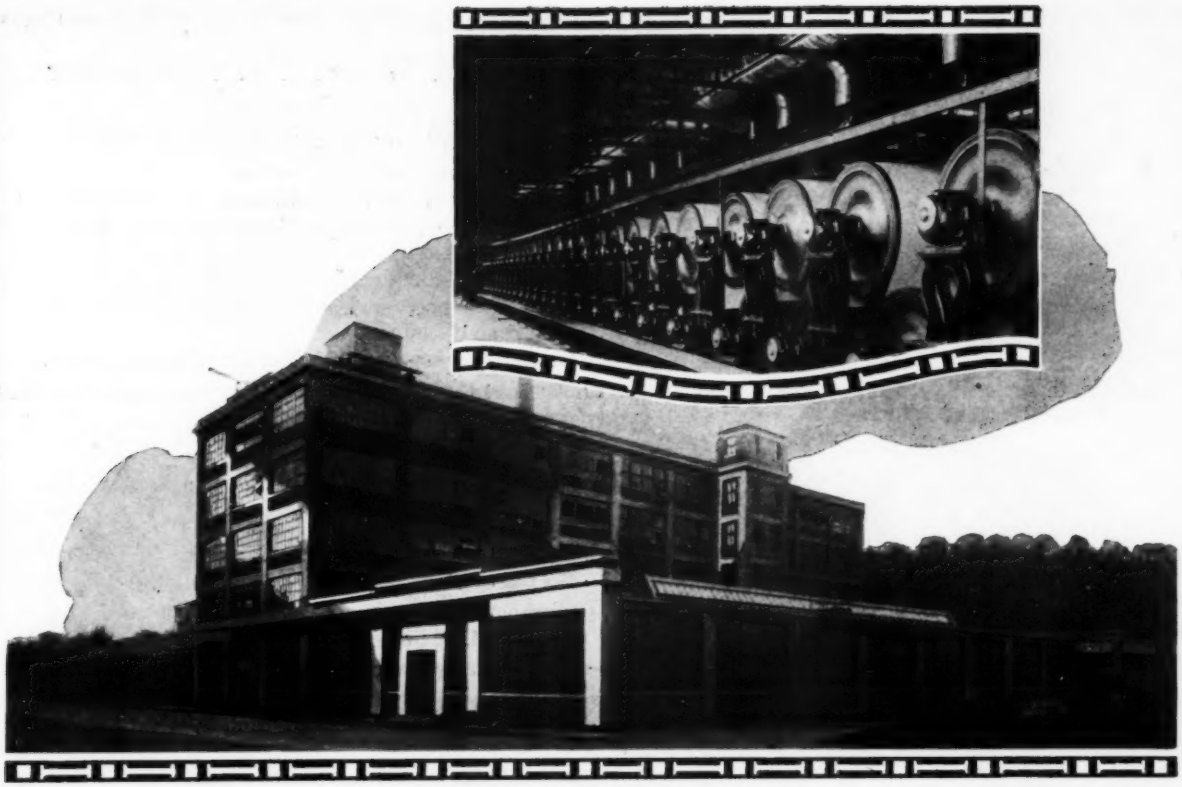
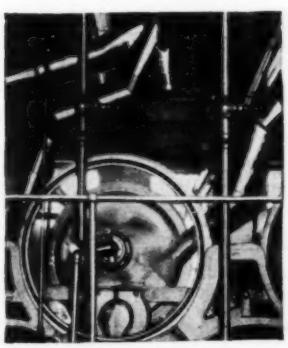


Charles Boldt Paper Mills, Cincinnati, O.

Increased Production Through Modern Methods

Clear air is playing an important part in the modern paper mill of today. In the Charles Boldt Paper Mill shown here, a SIROCCO Vapor Absorption system insures clear air in the paper room and better working conditions for employees. Warm air is circulated from a SIROCCO Fan and Heater Coils through air ducts directly onto the paper rolls eliminating all moisture which would otherwise rise to the ceiling, condense and fall back onto the finished stock.



Detail showing warm air ducts leading to paper roll

The commanding position which the Paper Mill occupies in the industry today means that every step should be taken which will insure a high quality product and more satisfactory working conditions. SIROCCO Equipment in the paper mill insures this.

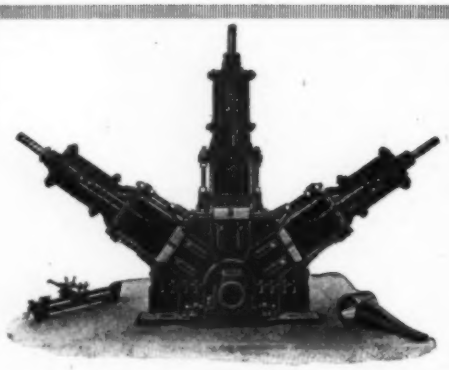
We have a new paper bulletin which gives details of ventilation in the paper mill with suggestions and photographs of particular interest to those interested in the paper industry. A copy will be sent upon request.

AMERICAN BLOWER COMPANY

DETROIT

"Sirocco"

TRADE MARK



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Taking wood 24″, 30″ or 32″.
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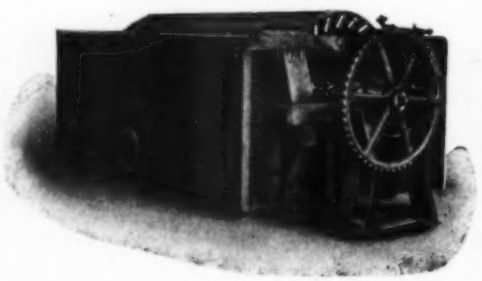
Pockets—Very heavy and designed particularly for free discharge of pulp.
Service—Continuous distinctive service is always assured.



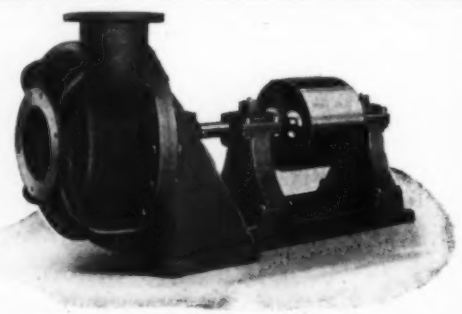
The Wood's Machine

Used as Pulp Thickeners, Savealls, Pulp Washers and Water Filters

ADVANTAGES:

Reduced Wire Costs	No Couch Roll
Enormous Capacity	Minimum Repairs
Only 2 H. P. Required	No Doctor
Works Automatically	Requires No Attention

TWENTY-THREE SOLD DURING THE PAST YEAR



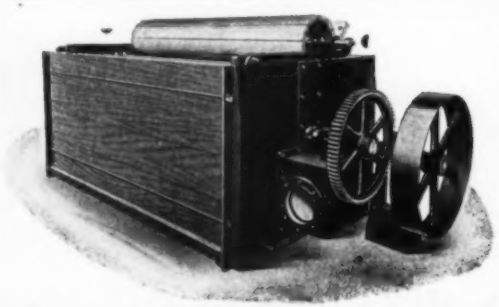
Heavy Duty Paper Mill Pumps

Built Especially for Handling Stock

Impeller—Extra wide, enclosed type and perfectly balanced against vibration and end thrust.

Suction Inlet—Is of large area, giving a free and easy entrance to same.

Our Pumps are economical in use, simple in construction, of very great durability and discharge continuous steady stream.



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Single or Double Cylinder Type

Built in the following sizes:
Cylinder mould diameter, 36″ or 40″.
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Cylinder mould of best reinforced construction and properly supported with our latest design outside bearings.
Vat furnished either all wood or with cast iron ends.
For Stability and Efficiency our Improved Deckers are Unexcelled

PULP AND PAPER MILL MACHINERY
GLENS FALLS MACHINE WORKS
GLENS FALLS, NEW YORK

How Long Is It Possible to Delay Repairs?

THERE has come a practice among the paper mills—and this practice exists in all lines of manufacture, including the railroads and public service companies—to delay all manner of upkeep and maintenance. This has been due, of course, to the fact that labor and every kind of material has advanced to such a degree in price, that everyone has waited in the hope that prices would come down.

There have been many reports from sources that ought to be reliable, that prices were to soon come down, but when trying to figure on any item we do not find this to be the case. But granting that this is true, or to be true, it will be some time before a material decline takes place, and in the meantime what is to be done?

Repairs, overhauling, and all kinds of maintenance have been put off, and are being put off, awaiting a more convenient season. This practice may spell disaster in many plants, for this kind of work cannot be put off until prices get to such a figure that they suit us. This work must be done, and cannot be put off indefinitely. Managers and superintendents of paper and pulp mills should see to it the plants are kept in tip top shape, for unless this is done a day may come when the plant may be closed down, and the trouble and expense will then be greater than it would be if this work was done as in normal times. More rigid inspections than ordinarily should be made all of the time to see to it that machinery and appliances in the mills are kept in the best possible shape, and every weak point in building or machinery ought to be corrected immediately. This may save considerable worry and expense later.

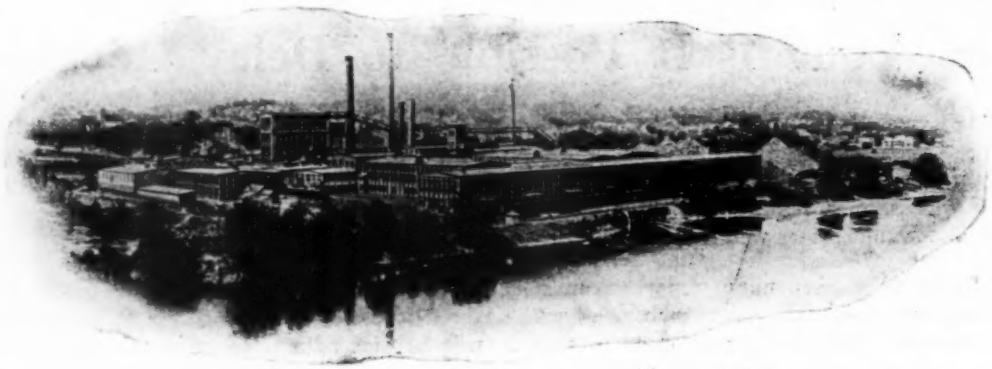
The Harbinger of Prosperity

THE freight car is not a thing of beauty, but it gets there, just the same. That is, it does in times of prosperity, and when the freight car does not get there, something is wrong with conditions in this country. To people who are not acquainted with the real facts, freight cars are only intended to stand on side tracks and obscure the landscape as we go by or to get ahead of one's train and get stalled, or many other things that are not nice. But from the plaints that have been going up to high heaven recently by railroad managers, and manufacturers, one would think this homely instrument of commerce was the universal panacea for all of our ills.

The trouble is, there are many too few of these freight cars, too few of engines to pull them, and too few of men to handle them. Many of them now in existence are in a shocking state of repair, and the end is not yet, so it seems.

The only alternative at this time seems to be to boost the "ship by truck" movement, wherever this can be done, and it is for this reason that we are publishing each issue, articles on the value of the motor truck.

It behooves every manufacturer and shipper of paper, as well as any other commodity, to do his "durndest" to help straighten out this chaotic condition, and help the railroads to get a proper rate for freight so they may be able to get more cars, and put these they have in condition to operate, to handle cars as expeditiously as possible when they arrive at their destination, and at the same time boost the "ship by truck" movement, and eventually we will get back to normal conditions, but we will not get anywhere with each one sitting idly by and wishing for the other fellow to make a move.



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High Grade Machine Finish and S. and S. C. Book Paper

CAPACITY OF MILL, 275 TONS OF PAPER PER DAY

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Mills: St. John, N. B., Canada

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Sulphite Bonds
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Bleached-Specialties

Machine Glazed Plain and Watermarked Specialties

¶ One 100-inch Cylinder Machine, producing Solid Manilas, Single Lined and Double Lined Boards for Carton and Paper Can purposes.

¶ One 120-inch Fourdrinier Machine, producing Sulphite Bond, and Bleached Papers for special conversions purposes.

¶ Two 120-inch Yankee Machines, producing Machine Glazed Papers in Plain and Special Stock Designs, as well as Special Watermarks.

Daily Production, 200,000 lbs.

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CONWAY BUILDING,
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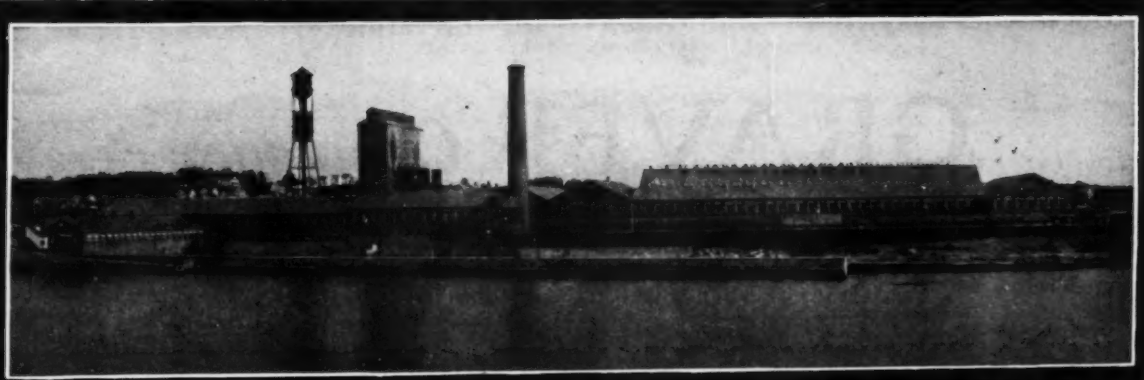
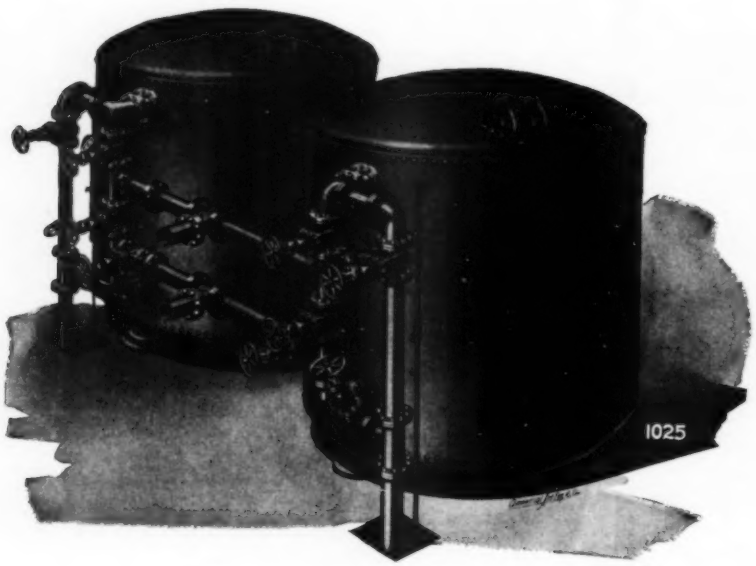


GRAVER
Water
Softening & Purification
HEADQUARTERS

GRAVER *Filters*



Graver Water Filters will deliver properly clarified water to meet every demand.

Graver Service begins with filling your request for information, extends through the anaylsis of your water conditions, provides for the proper installation and starting of the correct equipment, and continues throughout the full term use of the equipment.

Write for further information regarding the various types of Graver Filters.

GRAVER *Corporation*

(WM. GRAVER TANK WORKS · FOUNDED 1857)

Steel Tanks and General Steel Plate Construction
Water Softening and Purifying Equipment

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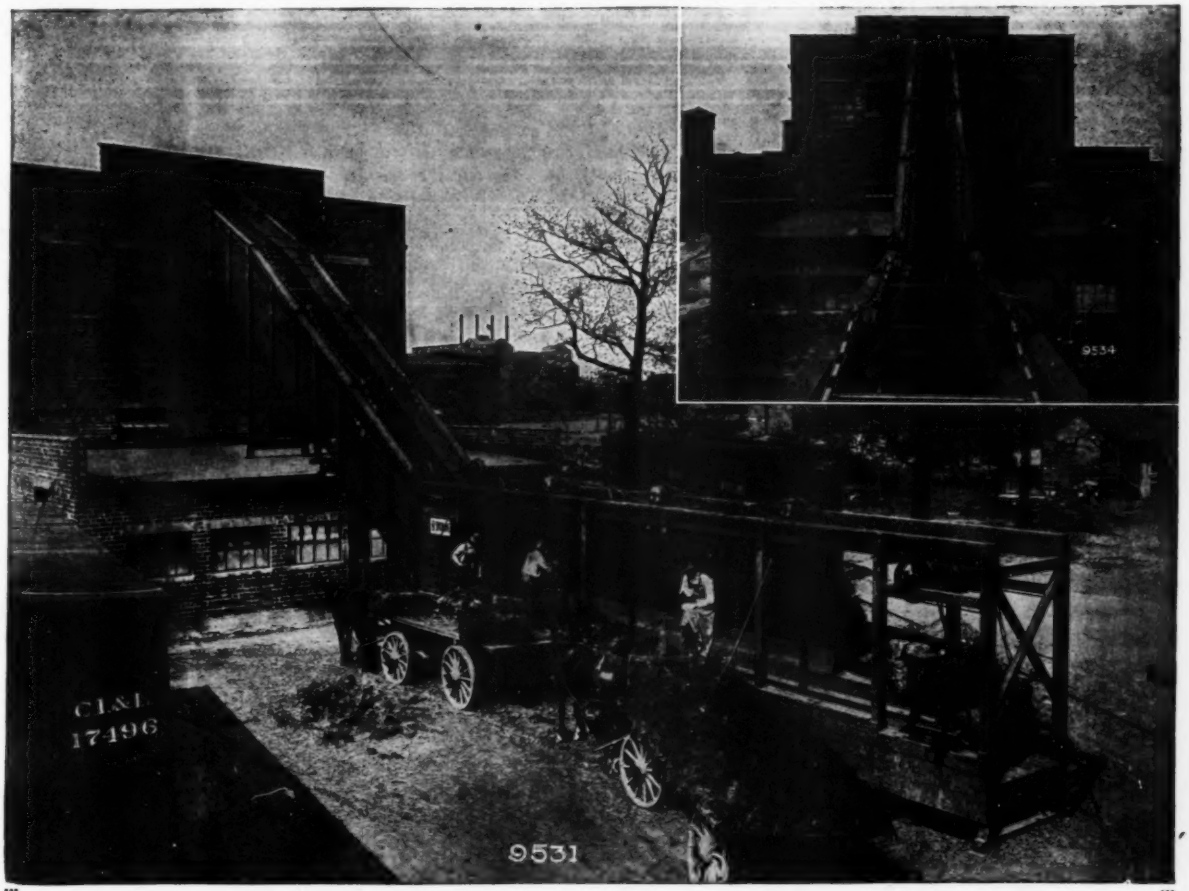

The Terre Haute Paper Company Are Proud of Their Jeffrey Straw Carriers

FROM the wagons the straw is dumped on the dry straw carrier which extends out of doors, as illustrated. The load is carried on bottom strand so it can be dropped through into digesters over which the carrier passes inside the building. From the digesters the wet straw is dumped on another conveyer which carries it up and over the beaters.

Both the wet and dry straw conveyors are made of Jeffrey No. 516 Round and Flat Link Chain with pipe attachments spaced at intervals of every 6 feet.

Let us figure on your conveying requirements

The Jeffrey Mfg. Co. 813 North Fourth Street Columbus, Ohio

Branch Offices:

New York	Charleston, W. Va.	Pittsburgh	Birmingham
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Detroit	Los Angeles	St. Louis	Denver
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Manufacturers of a complete line of Elevating and Conveying Machinery; Pulpwood Stackers; Malleable and Steel Chains; Coal and Ashes Handling Equipments; Coal Crushers; Coal Loaders; Shredders for reducing Bark, Wood Chips, Pulp Laps, Etc.

We believe that American business can be lifted from its present uncertainty only by constructive co-operation—the substitution of intelligent competition for blind, destructive competition.

Not Controlling Competition

The Fourdrinier Wire Manufacturers are not "controlling competition" or attempting to control it; they are not a "combine" against the buyer or against other manufacturers; there are no "agreements" to do this, that, or the other thing to the market; each manufacturer is absolutely free to follow his own good judgment as to the prices he quotes or at which he sells.

But Stimulating Constructive Competition

The knowledge made available by an "open market" takes the mystery out of "price," and institutes competition for quality and service. In other words, the manufacturers adopt the merchandising principle—"not how cheap, but how good, can we make this product?"

Questions are welcome.

Paper Machine Wire Manufacturers' Industrial Council

Directed by the Armstrong Bureau of Related Industries
11 La Salle Street, South, Chicago, Illinois

Get Busy Now or Shut Down Later

PAPERS of all kinds are still in persistent demand, and changes of great importance have occurred in the general paper market since our last issue.

The most significant change and also an indication as to the inherent strength in the paper situation is found in the demand for ground wood pulp. This basic raw material is reported as bringing the record price of $150 per ton. We learned that $140 a ton had been paid last week, but sales at $150 a ton have just been given us upon prime authority, but even at this price only limited quantities were available.

With pulp wood prices high and the supply this year estimated all the way from 25 per cent to 50 per cent less than a year ago, there seems to be little likelihood of any shading from the present quotation.

This advance in price is tremendously significant particularly at this time, for it is in the spring of the year that the production of ground wood is generally very greatly in excess of the market demand, and it has been the custom of the pulp mills to produce an excessive supply. Not so this year. Ground wood has gone into ready consumption, and there has been little piling up of supplies against the time when water is low and ground wood production is slow.

Ground wood at 7 to 7½ cents a pound ought to make the users of news print and other papers based on ground wood sit up on their hind legs and "woof."

All other kinds of pulp must rise. We have already heard of sales of unbleached sulphite at $180 to $200 a ton, so a balloon ascension in paper prices is due soon, and what these prices will eventually be is a thing that we do not like to hazard a guess on. One thing, however, is certain, and that is that peak prices on both pulp and paper have not yet been reached.

Transportation, labor and the coal situation are the elements that are contributing to the advance in the basic raw materials of the paper industry.

The situation on coal is particularly critical. The foremost authorities on the coal situation believe it is already too late to save the industry of the country from the serious results of the spring strikes. Dissatisfaction and slackening of production exists in most of the soft coal districts; result, insufficient output of coal. It is now the middle of June, when production of coal should be at its highest and stocks should be piling up at mines, in railroad yards and at docks. The wholesalers, retail dealers and consumers of coal throughout the country should be obtaining their next winter's supplies, but the supply of coal is short, sufficient only to meet current demands. What the situation will be this winter, unless a miracle intervenes to stimulate the production and transportation, is something that ought to be readily imagined but hard to describe at this writing.

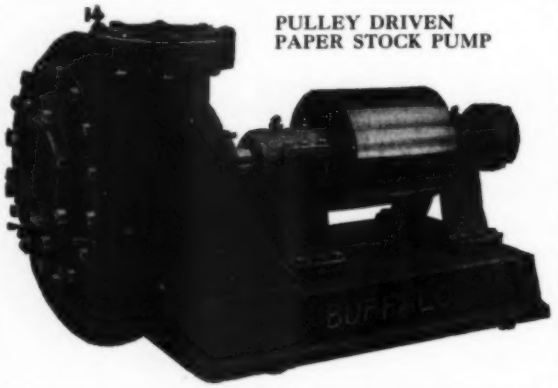
Even if sufficient coal were mined, it is doubtful whether over 75 per cent of the normal demand for coal could be transported over the railroads.

Increased production is needed to keep prices stable and to bring them down. It is folly to think of increased production when there is no possibility to increase or even maintain the necessary power.

The railroad situation has eased somewhat on current shipments, due to good weather, but the congestion is as vicious and great as ever.

We call attention to this phenomenal rise in the basic raw material in the industry. In April, ground wood was quoted at from $60 to $70 a ton, and the trade noted the price with passing interest only. In sixty days the price has more than doubled. We say it is phenomenal and significant. From no quarters have we seen so far any particular analysis of the reasons for this advance or any suggestions of a remedy to prevent its going higher. A runaway pulp market means a disastrous, speculative paper market. Both should be avoided in the interest of the entire industry.

It would seem unnecessary to issue a warning to the members of the paper industry. The significance in the course of the prices of the basic raw materials, such as pulp wood, ground wood and chemical pulps, ought to be sufficient to show the trend of what is going to happen. The outlook now is plainly serious. When will the manufacturers of pulp and paper get together to consider the menaces that mean a shut down of the industry? This is no time to be timid. The situation calls for bold, concerted action.



PULLEY DRIVEN
PAPER STOCK PUMP

Buffalo Paper Stock Pumps

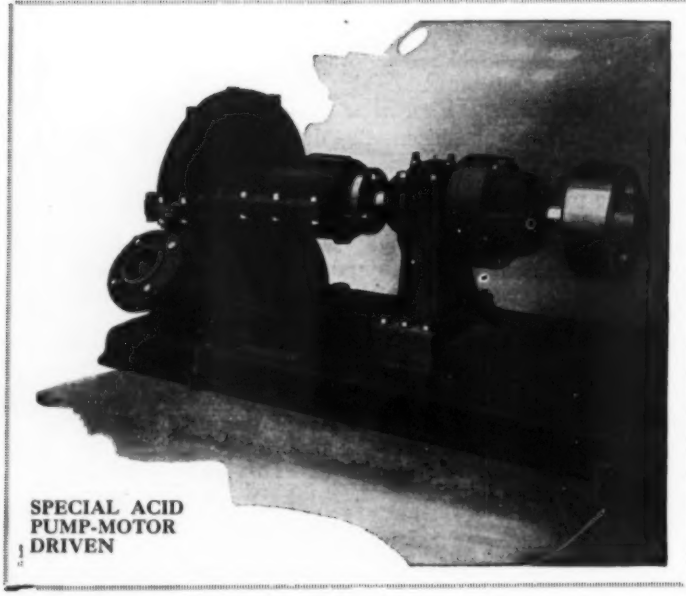
ARE what you should standardize on throughout your mill. They will reduce your power cost and they stand up under the most severe service. The volume of repeat orders we receive from the largest mills is the best testimonial you could ask.

Handle 4% Ground Wood Stock Continuously without Clogging

Let us co-operate with you on any special problems you may have.

This special Buffalo Acid Pump is made of Bronze for handling sulphite liquor. Very heavy construction throughout—extra deep stuffing boxes—large bearings.

***Write for Bulletin* 953-27**



SPECIAL ACID
PUMP-MOTOR
DRIVEN

Buffalo Steam Pump Company

BUFFALO, NEW YORK

Manufacturers of Steam, Power and Centrifugal Pumps and Condensers

New York	St. Louis
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CAST Iron is one of the few materials to which *age gives an appreciated value.*

Pipe of this material has recently been taken out of the ground (in places where the need for its use no longer exists) and sold for several times its original cost.

"In cast iron pipe you are dealing with a certainty," says an eminent engineer—certainty of service and value.

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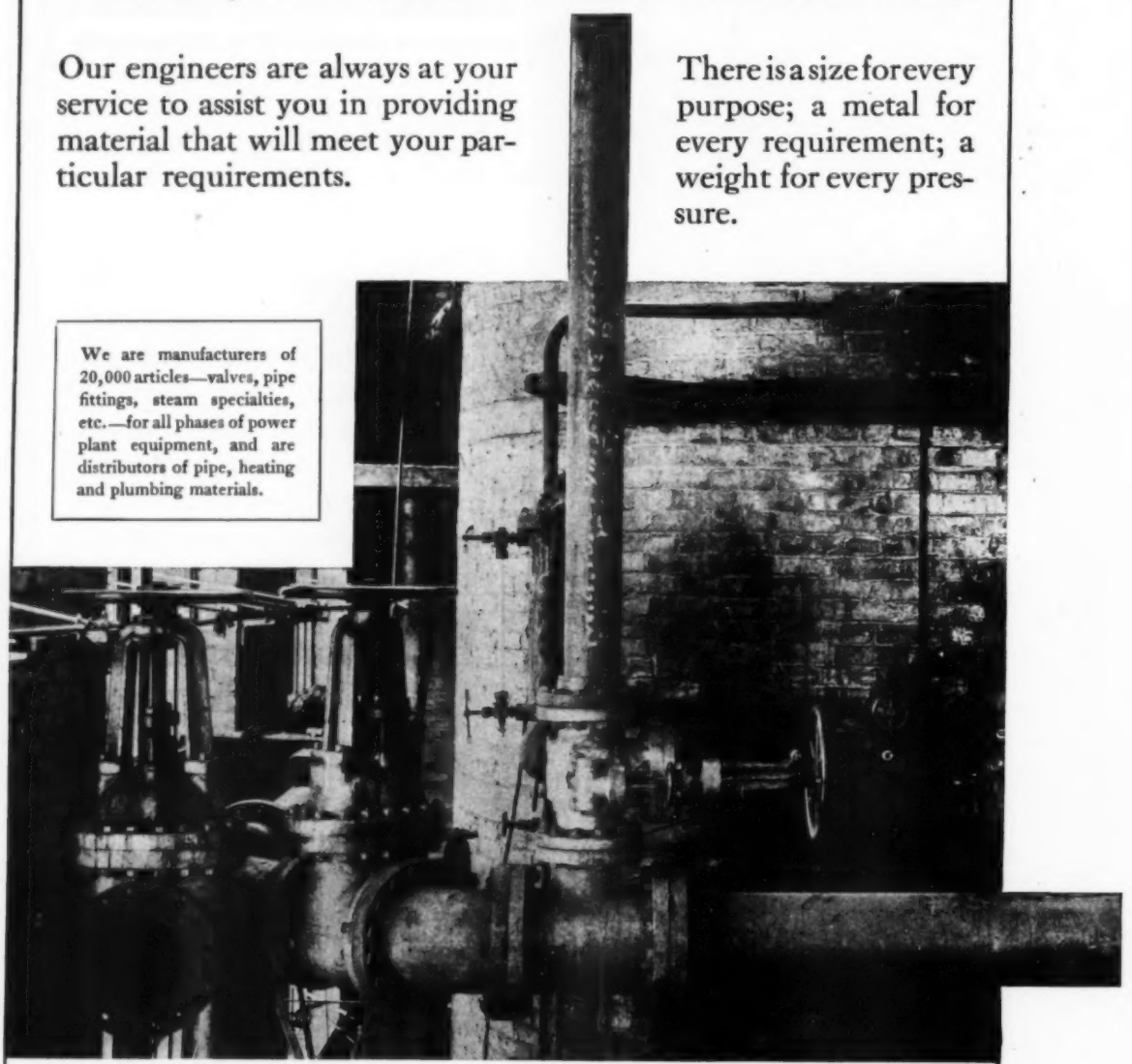
There is a size for every purpose; a metal for every requirement; a weight for every pressure.

We are manufacturers of 20,000 articles—valves, pipe fittings, steam specialties, etc.—for all phases of power plant equipment, and are distributors of pipe, heating and plumbing materials.



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"BUFLOVAK" EVAPORATORS AND VACUUM DRYERS

If there ever was a time when manufacturers should be especially careful in the selection of their equipment, that time is now. There is only one way to be absolutely sure of the good quality of your equipment and that is to be sure of the organization that builds it.

The world is composed of two classes, those who LEAD and those who FOLLOW. "Buflovak" products have been leaders since they were first introduced. Others have imitated, but no one has duplicated their value.

"Buflovak" Evaporators

are built in all types and for any capacity. We have special types for concentrating black liquor, sulphite waste and other by-products of the pulp and paper industry.

Horizontal and Vertical Tube Evaporators; Rapid Circulation Evaporators; High Concentrators for caustic soda, potash, etc., Leaching Cells, Causticizers, Digesters, Caustic Pots and other apparatus for soda, sulphate and sulphite mills.

"Buflovak" Vacuum Dryers

Have you ever considered the possibilities of recovering your sulphite waste and converting it into a salable product? This is one of the fields developed through the "Buflovak" Vacuum Drum Dryer, which converts the liquors into a dry, powdered form at low cost. We will gladly tell you about it.

Vacuum Dryers, furnished in all types; Vacuum Pumps, Condensers, etc.

Catalog and Full Information on Request

Buffalo Foundry & Machine Co.
1599 Fillmore Ave., Buffalo, N.Y.
NEW YORK OFFICE 17 BATTERY PLACE

Work

By Angela Morgan

WORK!
Thank God for the might of it,
The ardor, the urge, the delight of it.
Work that springs from the heart's desire.
Setting the brain and the soul on fire—
Oh, what is so good as the heat of it,
And what is so glad as the beat of it,
And what is so kind as the stern command,
Challenging brain and heart and hand?

Work!
Thank God for the pride of it,
For the beautiful, conquering tide of it,
Sweeping the life in its furious flood.
Thrilling the arteries, cleansing the blood,
Mastering stupor and dull despair,
Moving the dreamer to do and dare,
Oh, what is so good as the urge of it,
And what is so glad as the surge of it,
And what is so strange as the summons deep,
Rousing the torpid soul from sleep?

Work!
Thank God for the pace of it,
For the terrible, keen, swift race of it;
Fiery steeds in full control,
Nostrils a-quiver to greet the goal,
Work! The power that drives behind,
Guiding the purposes, taming the mind,
Holding the runaway wishes back,
Reining the will to one steady track,
Speeding the energies faster, faster,
Triumphing over disaster.
Oh, what is so good as the pain of it,
And what is so great as the gain of it,
And what is so kind as the cruel goad,
Forcing us on through the rugged road?

Work!
Thank God for the swing of it,
For the clamoring, hammering ring of it—
Passion of labor daily hurled
On the mighty anvils of the world,
Oh, what is so fierce as the flame of it,
And what is so huge as the aim of it?
Thundering on through dearth and doubt,
Calling the plan of the Maker out,
Work, the Titan; Work, the friend,
Shaping the earth to a glorious end,
Draining the swamps and blasting the hills,
Doing whatever Spirit wills—
Rending a continent apart,
To answer the dream of the Master heart,
Thank God for a world where none may shirk,
Thank God for the splendor of work!

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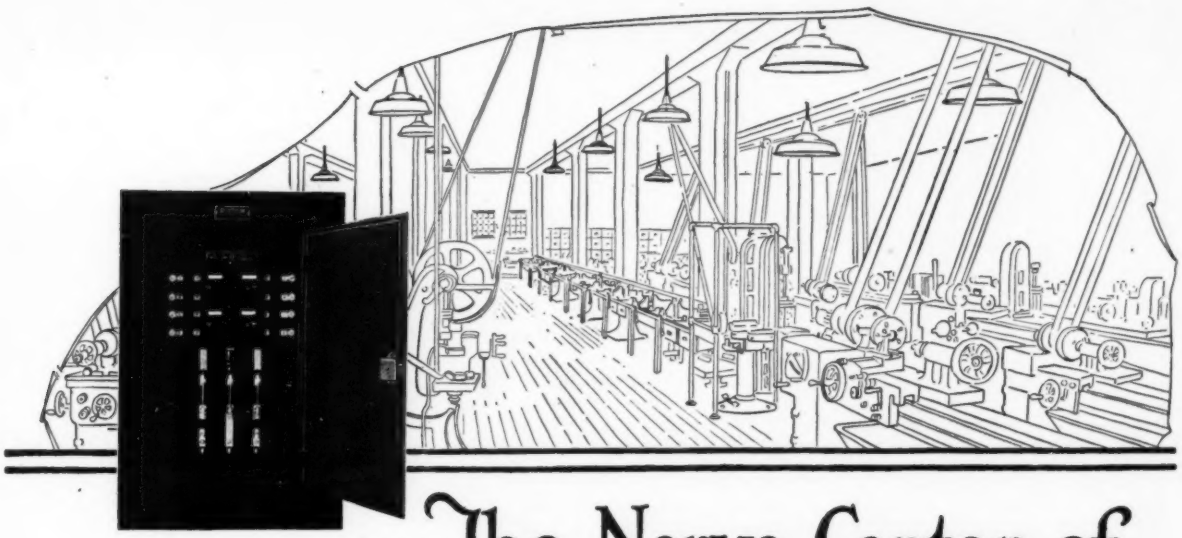

The Nerve Center of Your Illumination System

AS the nervous system distributes its energy through the nerve centers, so the entire plant lighting system centers in and radiates from the panel boards.

Important? Of course!

Benjamin-Starrett Standard Open Front Panel Board is the highest development of panel board construction—made and sold by an organization that takes pride in doing good work.

For all panel board purposes from 4 circuits up there is a Benjamin-Starrett Standard Open Front Panel Board—anywhere—wherever a panel board can be used; or anytime—it will be delivered on short notice. All this because of its accurate, factory inspected, unit construction. It can be installed quickly, easily and cheaply—an item to consider in these days of high labor cost. And you can be proud of the appearance of the finished installation.

There is no good reason for your having anything but the highest quality of workmanship and material on so important a part of your equipment. Consult with your architect, or electrical engineer *today* concerning Benjamin-Starrett Panel Boards. Your own electrical contractor knows where to get them and install them.

And remember—it's the safest, most adaptable and most durable panel board you can have installed. Write for information today, addressing

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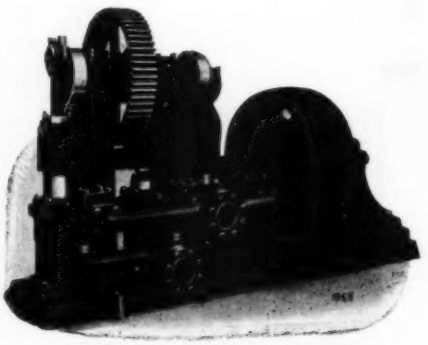
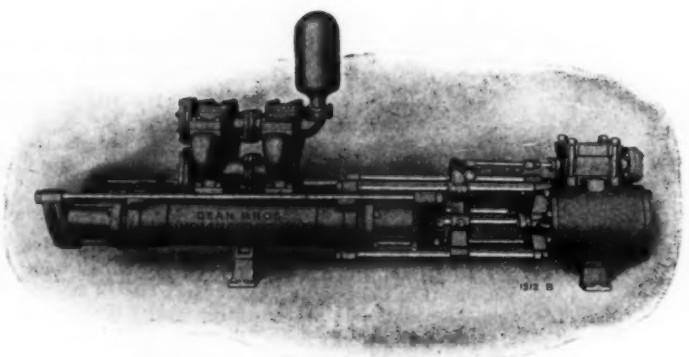


Vertical Triplex Electric Pump

PUMPS FOR ALL PURPOSES



Horizontal "Durable" Duplex Steam Pump

Fifty years of successful manufacturing, devoted exclusively to designing and building pumps, enable the purchaser of Dean Brothers' product to buy the correct pump for the service required

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STEAM PUMP WORKS
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Flexible as a Belt—Positive as a Gear—More Efficient than Either

WHERE flat belt and gear drives have failed, the Link-Belt Silent Chain Drive has solved many a power transmission problem. Its positive action (no chance for slip) delivers all the power of the motor to the machines, getting the most out of them.

Its flexibility absorbs all shocks, protecting the motor, and delivering a smooth, steady flow of power to the machine. You should use this highly efficient drive for operating the various machines and lineshafts in your plant.

Let one of our experienced power transmission engineers help you solve any bothersome transmission problem. Send for Link-Belt Silent Chain Price-List Data-Book No. 125. It shows how to figure drives and determine prices. Sent free on request.

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"Excellent Satisfaction"—The Cleveland-Cliffs Iron Co.

Aladdin Readi-Cut Houses universally give satisfaction. The most difficult industrial housing problem can be simplified and solved by the Aladdin method and without the slightest slip or hitch.

It is customary in the Logan Field for the mining company to furnish housing for the employees. Therefore at the Ethel Mines, the Cleveland-Cliffs Iron Company had the usual precedent to follow. Their housing problems were solved with Aladdin Readi-Cut Houses, regarding which they write, ***"We shall be pleased to have you use our name as reference, as the houses which we have already purchased from you have given us very excellent satisfaction. As our operations expand more houses will be necessary."***

This is but one of the many instances where the Aladdin service has solved the housing problem. Better houses, lower in price, more quickly erected, these are the expressions of satisfaction we hear from every customer.

Aladdin—

—expedites your building project—
—houses your men well and quickly—
—saves 18% of the cost of lumber—
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—reduces the skilled labor required—
—guarantees complete shipment of material—
—guarantees the quality—
—carries material for 1000 houses in stock—
—ships from the nearest timber region—

—quotes definite prices on any order from one house up to a city of 3000, including churches, schools, offices, water and sewage systems, electric plants, street and house lights, heating plants, street parks, trees, lawns, etc., complete.

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Industrial Housing

THE TROPICAL PAINT & OIL CO.

ELASTIKOTE

A Paint for Industrial Buildings

Made on a different formula

FOR many years we have been manufacturing Elastikote for use on Industrial Plants and number among its users, Hammermill Paper Co., Kimberly-Clark Co., Fletcher Paper Co., and many other paper manufacturers.

The darker shades of Elastikote are made from a mineral gum base instead of a lead and zinc base for the reason that this formula gives better results in factory districts. The exterior surfaces of industrial buildings are usually subjected to smoke, steam and gases, which soon cause lead and zinc paints to darken and disintegrate. The elastic gum used in Elastikote is not affected by these conditions and for this reason painting with Elastikote gives many years of protection in factory districts.

Elastikote can be used on wood, brick or metal surfaces.

One of our representatives will be glad to call and give you prices and complete information regarding this Paint. Send for a sheet painted with Elastikote and test its elasticity and resistance to steam, smoke and fumes.

CLEVELAND, OHIO.

ECONOMY *renewable* FUSES

have for years cut 80% out of the annual fuse maintenance costs of all industries using electrical energy.

The simple, accurately rated, inexpensive Economy "Drop-Out" Renewal Link is easily and quickly replaced when a fuse is blown.

In the higher capacity fuses, multiple Economy "Drop-Out" Renewal Links are used, as shown in the illustration.

The Winged Washer adds to the ease and convenience of renewing the fuse.

Extra heavy brass end caps, knurled and threaded, complete the fuse assembly.

ECONOMY renewable FUSE was the first fuse using an inexpensive bare renewal link for restoring a blown fuse to its original efficiency to gain full Underwriters' Approval IN ALL CAPACITIES.

Buy Economy Fuses and Economy "Drop Out" Renewal Links from leading electrical jobbers and dealers

ECONOMY FUSE & MFG. CO.
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Economy Fuses are also made in Canada at Montreal

Insist on these marks of official approval:

The symbol on the link

The label on the fuse

Dodge Wood Split Pulley

5 MILLION SOLD SINCE 1882

Guaranteed for Life

LIGHT TRUE RUNNING

A Dodge wood split pulley is lighter and more carefully balanced than any metal pulley; the tractive pull of a belt on a wood rim is greater than on an iron or steel rim; and you can expect a quicker delivery of both stock and special sizes of wood pulleys than is possible of any other type.

When you need transmission products in a hurry call the local dealer. He stands for all that we represent nationally—buy from him.

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Dodge Sales & Engineering Company, distributor of the products of the Dodge Manufacturing Company and the Dodge Steel Pulley Corporation. General Offices: Mishawaka, Ind. Works: Mishawaka, Ind., and Oneida, N. Y.

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THE LENIX DRIVE

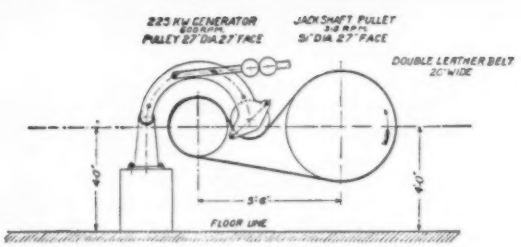
COMBINES THE

COMPACTNESS

of direct-connected, geared or chain drives with the

FLEXIBILITY

of a belt drive as in the illustration below of a LENIX installed on a 225 K.W. generator drive



The LENIX permits absolute freedom in the relative location of shafts and ratio of pulleys, and operates equally as efficiently whether drive is vertical or horizontal or tight side of belt on top or on bottom. It saves in floor space, belting and power and prevents slippage.

There are many installations of LENIX drives in paper mills and it has been found the ideal drive for beaters and other machines in the Paper Industry particularly where compact and resilient drives are required.

Irrespective how small or how large the horsepower requirements or the nature of the driving conditions, The LENIX will solve your driving problem.

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"Saving Slippage and Space"

F. L. SMIDTH & CO.

50 Church Street *ENGINEERS* NEW YORK CITY

Four Reasons Why—

WIDNEY MODULIMETER
A TEST
PATENTS PENDING

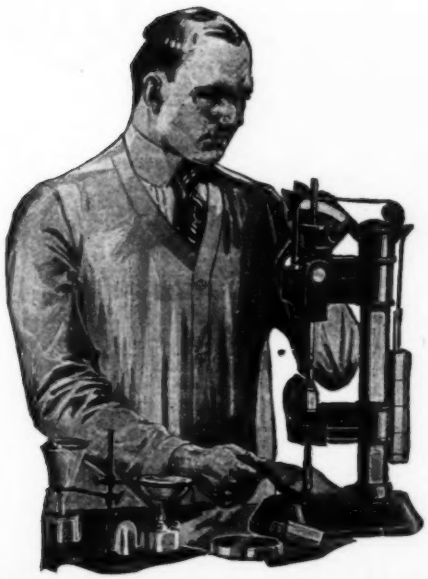
will ultimately be installed in every paper mill:

1. It tells the mill superintendent just what he has in all the important physical qualities in his product at any stage.

2. It tells him definitely regarding all the physical qualities in the supplies he buys and uses.

3. It affords him the first and only accurate test of his product for its tearing and folding strength, elasticity, stretch, stiffness, recoverance and point of collapse.

4. It enables him to do all his testing with one Universal Tester, thereby eliminating the necessity of a separate instrument for each test.



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MANUFACTURERS OF

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COLOR QUALITY AND UNIFORMITY
HAVE MADE FOR IT
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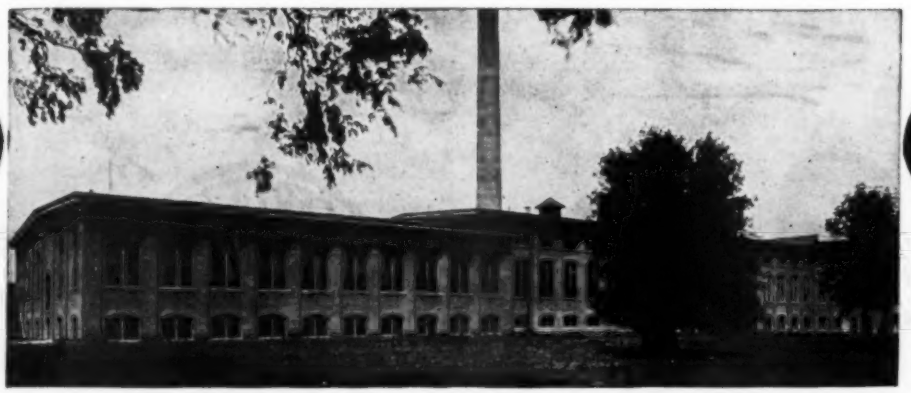
PLCo.

The Symbol of Quality



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LAKESIDE PAPER COMPANY

NEENAH, WISCONSIN

Quality and Service

MANUFACTURERS OF

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THE PRODUCTS OF INDIVIDUALITY

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STREHL OTENS COMPANY, Inc.

Paper Boards and Specialties

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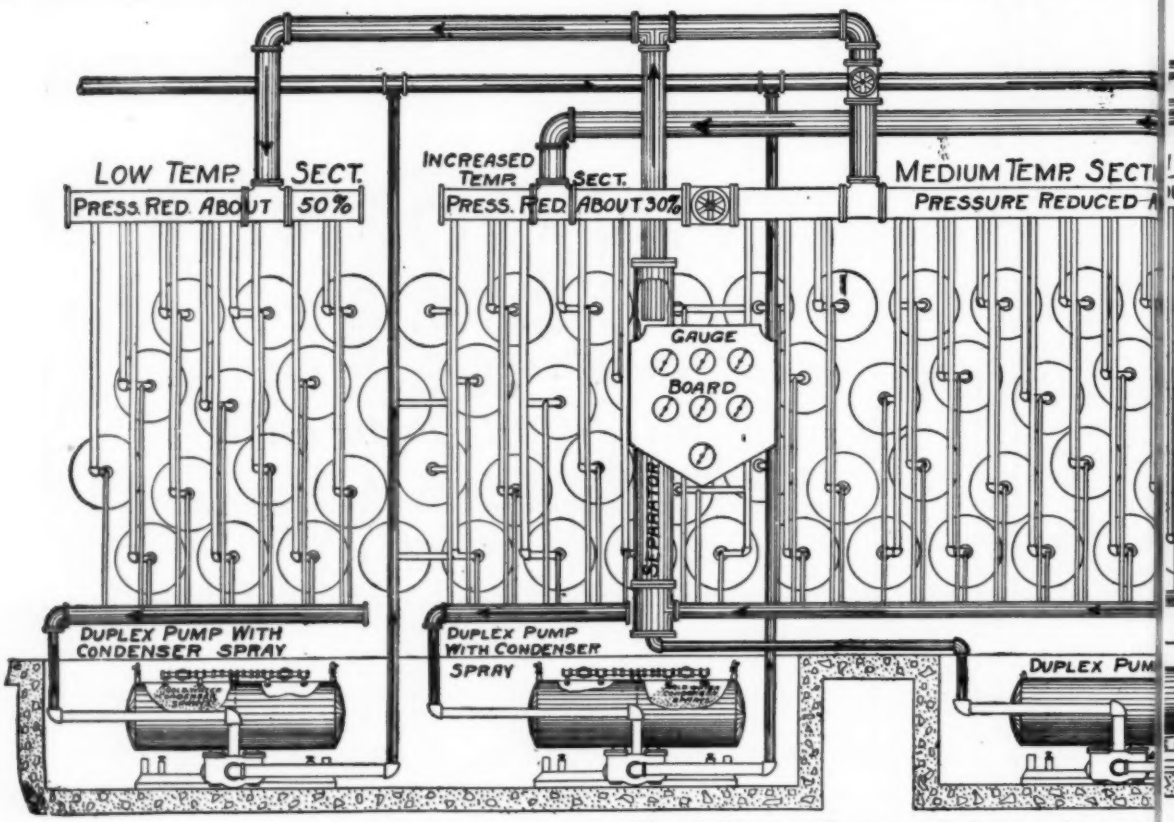
Explaining the Farnsworth Forced Steam Circulation System as



Sketch Showing Farnsworth System Applied

Exhaust steam or any pressure steam is applied on the dry end through the main steam valve, and supplies about 37½% of the dryers on the dry end of the paper machine with full pressure steam; the steam passes into the dryers and out into the main return header. The steam in the main return header passes over to the second wet end section, and the water is drained to a Farnsworth Duplex Condensation Pump from the Separator draining the return header of this dry end section, or high temperature section.

If there is insufficient steam coming from the return header of this high temperature section to supply the second wet end section with enough steam to heat these dryers, then the valve located directly above the Gauge Board is opened until sufficient pressure is built up in this section to suit the paper maker.

It will be noted that the pressure on the medium temperature section is reduced by a valve on the main steam header, and the pressure will, therefore, be supplied to the dryers of this section at a slightly reduced pressure or temperature. The steam blows through the dryers and out into the main return header; and the steam from this return header is carried through a Separator and supplies the steam header of the first wet end section.

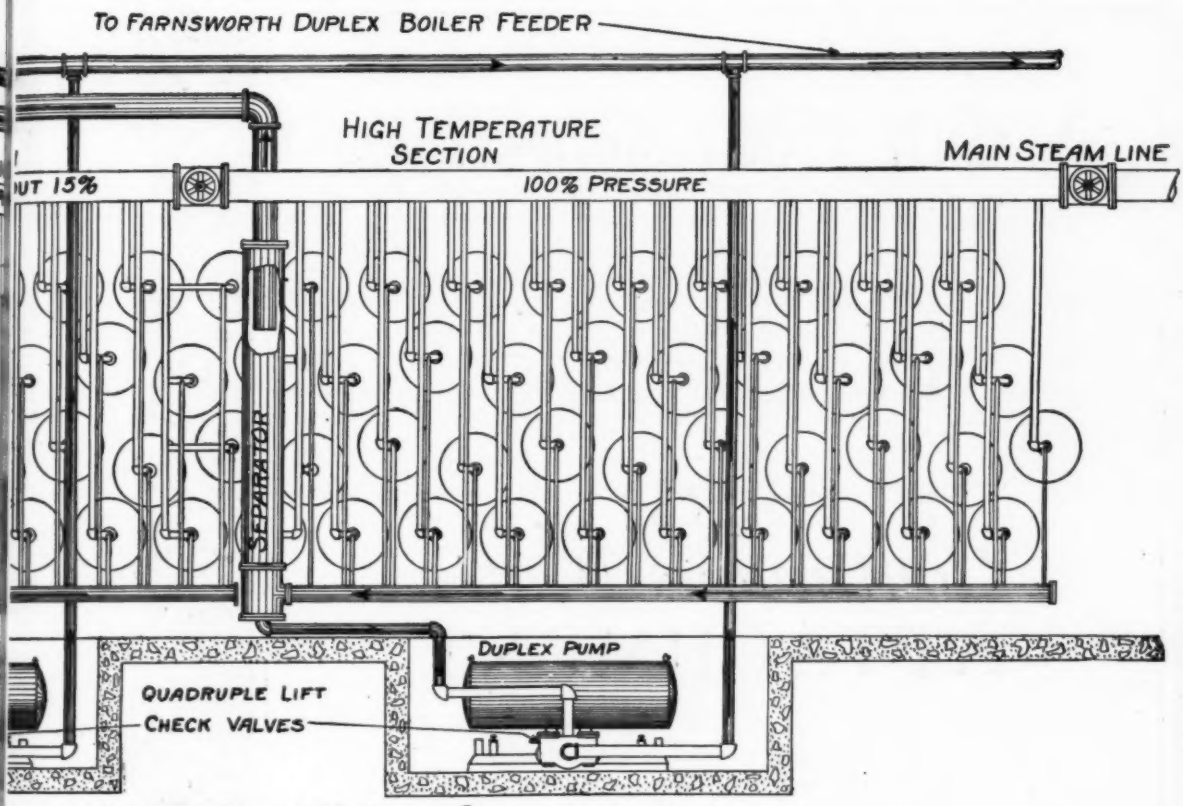
If insufficient steam comes from the main return header of this medium temperature section to supply the first wet end section dryers, then the valve above the paper machine is opened to build up the necessary pressure to suit the requirements of the paper maker.

The return headers of the first wet end section and the second wet end section are drained by Condenser Type Farnsworth Condensation Pumps. To explain the operation of the Condenser Type Machines: the cold make up water required to supply the boilers is fed through sprays in the top of the tank. These sprays condense the vapors in the return header of the two respective sections, thus causing a high velocity of steam to flow through the dryers of the low temperature section and the second wet end section. In other words, these condensers pull or suck on this return header.

As has been previously explained, the steam from the high temperature section and the medium temperature section blows straight through the dryers into the return headers and the return headers supply the two wet end sections, or low temperature sections of the Paper Machine, and then, as explained heretofore (to keep the steam traveling) the condensers used to drain the return headers of the two wet end sections keep the steam traveling at a high velocity through all of the dryers of the Paper Machine—with the result, that THE HIGH VELOCITY OF STEAM THROUGH THESE DRYERS ABSOLUTELY INSURES THE DRYERS OF BEING FREE FROM AIR AND WATER AT ALL TIMES, THUS PRODUCING THE MAXIMUM DRYING CAPACITY PER SQUARE FOOT OF RADIATING SURFACE IN EACH AND EVERY DRYER.

In addition to forcing the steam through these dryers this system provides positive control of the temperatures and provides a low temperature dryer at the wet end of the Paper Machine with a gradual increase toward the dry end of the Paper Machine. A better grade of paper is therefore produced, and it provides conditions which will permit increased production, because a higher temperature dryer can be used. Therefore, drying paper properly

Applied to the Large Board Machines Divided Into Four Sections



to Mills Where There Is No Basement

means increased production.

The old method of having the same pressure of steam on the wet end of the Paper Machine as on the dry end causes trouble, because the paper was too dry at the wet end and would naturally break if too high a temperature were carried, while with this System any pressure can be carried on the Paper Machine, because the paper hits the first dryers at a lower temperature, and then builds up gradually so that any pressure can be used that may be desired.

With this system a very low pressure can be used. In other words, the wet end sections might not have any pressure at all, yet the suction and the forced circulation of steam through the dryers would force the water out of the dryers, although there was not even the slightest pressure on the dryers.

This system makes it possible to dry paper with steam at less than atmospheric pressure, while heretofore, small traps on each dryer with a vacuum pump has deceived a great many paper makers. They thought that they had a vacuum up to the small trap on each dryer; and, as explained before, there is no necessity for a vacuum to pull the water out of the small traps, because the water will flow out of its own accord. This system can be applied to very small Paper Machines as well as the large Machines, as shown by the above cut.

The Farnsworth Guarantee

The Farnsworth Company guarantee with this system to extract all water and air from the dryers, and to produce maximum drying capacity per square foot of radiation in each and every dryer, and to provide better control of the steam to the Paper Machine; also to provide better drying conditions—that is, to provide a lower temperature dryer at the wet end with a gradual increase toward the dry end.

All our apparatus and machines are built extra heavy, tested to 350 lbs. pressure before leaving our plant, and fully guaranteed in every respect against defective workmanship, materials, etc.

What the Complete Farnsworth System Comprises

The Farnsworth Company supply the necessary plans and specifications and the services of an erecting engineer to properly supervise the correct installation of this system. We supply the proper size and style of Condensation Pump to properly drain the various sections of the Paper Machine, and at the same time hold the condensate under a pressure and pump it to any point of use; also the necessary Steam Separators between the dry end and the wet end of the Paper Machine. We supply the Gauge Board with the necessary Gauges to properly determine the pressure on the various sections; furthermore, the Farnsworth System and Apparatus can be applied to any Paper Machine without shutting down the Paper Machine. All preparations are made for the necessary changes, so that the Farnsworth System may be installed on Sunday when the machine is shut down.

FARNSWORTH COMPANY, Conshohocken, Pa.

Engineers and Manufacturers of Condensation Pumps. Farnsworth Forced Steam Circulation Systems for Paper Mills.

Canadian Farnsworth Company, Toronto, Canada

A Gilt Edge Investment

Saves its own cost six times over the first year in the power it conserves. Speeds up production. Requires no additional floor space or direct labor. Keeps stocks uniform. Removes rags and strings from board stock. And, better still, the—

BIRD
Continuous Beater
ATTACHMENT

—is a thoroughly tested, practical, effective, simple attachment, designed to be fitted to any ordinary tub—**at less than ⅓ the cost of** space-eating so-called Continuous Beaters.

One ordinary Beater plus one Bird attachment accomplishes the work of two Beaters.

Can be used as an intermittent Beater if special occasions warrant.

Request "Continuous Beating" Catalog "F"

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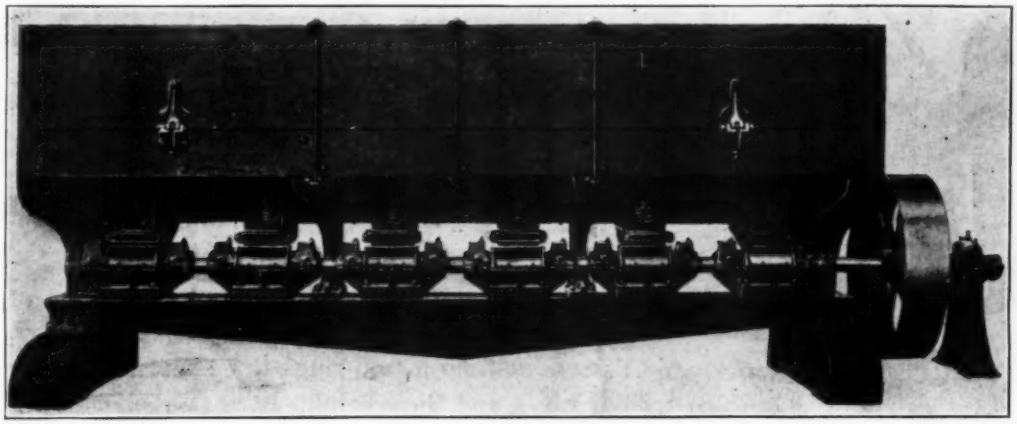
Pulp and Paper Mill Machinery



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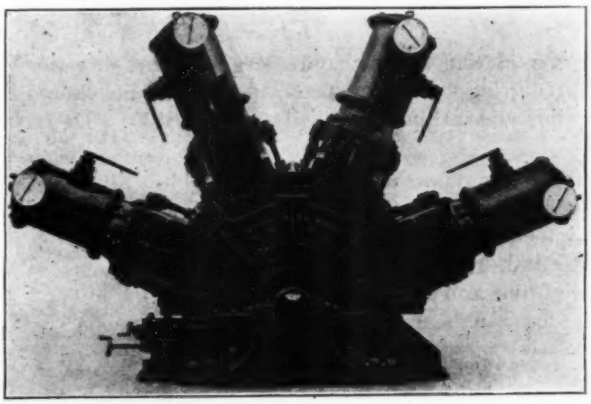

FOUR POCKET GRINDER
Equipped with **All Latest Devices,** *including our* **Patented Pulp Scraper between the Pockets**

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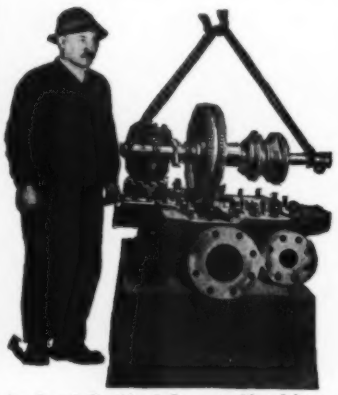
Union Iron Works, Bangor, Maine

CENTRIFUGAL PUMPS

for Feeding Boilers, Circulating Condenser Water, and All Other Water Requirements.



De Laval Combined Steam-turbine-driven Boiler Feed Pump for 3,000 boiler horsepower.

CENTRIFUGAL PUMPS simplify the boiler room equipment and make it more dependable. Piston and plunger packings are eliminated; the few bearings are ring-oiled. There are no valve gears to adjust, no piston rings to be kept tight. Valves and their troubles are absent.

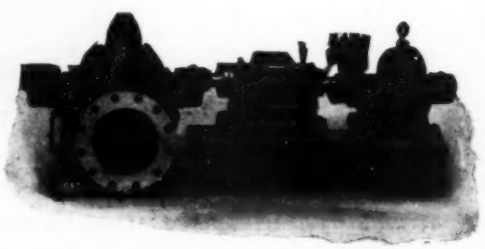
THE De Laval Combined Steam-turbine-driven Centrifugal Boiler Feeder occupies only about one-eighth as much space and weighs only about one-fifth as much as a reciprocating boiler feeder. The discharge is uniform and transmits no shock or vibration to the piping. Sudden cutting-off of the discharge does not result in excessive pressure, nor sudden opening up in racing. The smooth, uniform flow ideally adapts this pump for use in connection with automatic boiler-feed regulators and flow meters.

In De Laval Steam-turbine-driven Boiler Feeders the turbine and pump speeds coincide.

De Laval Centrifugal Circulating Pumps handle large volumes of water with high efficiency. As the head is usually small, requiring low pump speed, and the turbine should run at high speed to obtain good efficiency, the pump and turbine are usually connected by a De Laval Speed-reducing Gear.

De Laval Centrifugal Pumping units are simple and reliable. All parts are readily accessible upon lifting the casing covers and without disconnecting piping. Parts subject to wear, such as labyrinth wearing rings, bearings, impellers, etc., are built on an interchangable basis to limit gauges and can be renewed at small expense of time and money. Duplicates ordered from the shop can be put in place without requiring fitting.

The capacity and efficiency of each unit is guaranteed and a thorough test is made at the shop before shipment.



Geared-turbine-driven Centrifugal Condenser Circulating Pump; 5500 gal. per min.; 25-ft. head.

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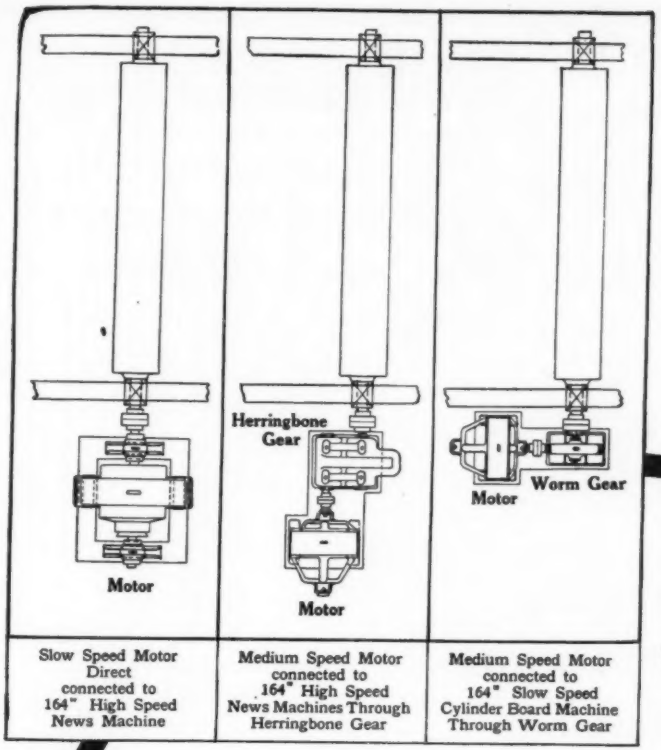
DE LAVAL STEAM TURBINE CO.

TRENTON, NEW JERSEY



Slow Speed Motor Direct connected to 164" High Speed News Machine	Medium Speed Motor connected to 164" High Speed News Machines Through Herringbone Gear	Medium Speed Motor connected to 164" Slow Speed Cylinder Board Machine Through Worm Gear

Sectional Individual Motor Drive

that meets Every Requirement of

Paper Machines

These views show actual floor space required

Sectional Individual Motor Drive That Meets Every Requirement of Paper Machines

Although the same principles are involved in driving high speed news machines, medium speed book or specialty machines and slow speed cylinder board machines, the mechanical arrangement of the drive is often necessarily determined by the space available for its installation.

The Westinghouse system of sectional individual motor drive utilizes apparatus of such simple nature that it lends itself admirably to use in limited space. This is evidenced by the above illustrations of the three possible mechanical arrangements of this drive, which affords a choice to best meet specific space requirements.

In the illustrations, a direct-connected, slow speed motor, a medium speed motor with herringbone gear and a medium speed motor with worm gear are shown. It will be found that in most instances one of these three mechanical arrangements will be preferable.

The ultimate results, namely, increased production, lower maintenance and improved mill conditions are obtained by the use of any one of these arrangements.

Our representative will be pleased to go over this further with you. Write our nearest district office.

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THERE are in America, in the textile, paper, leather and allied industries, 67,585 *separate* establishments dependent, directly or indirectly, upon regular and uninterrupted supplies of dyestuffs.

In these factories, which represent an investment of four billion dollars, over two million people are employed. They produce annually in manufactured goods nearly six billions of dollars or 25% of the country's total output of manufactured products.

American dyestuff manufacturers are straining every effort to keep these thousands of factories running, these millions of workers employed and the flow of manufactured products unbroken. For these efforts to be successful however, American manufacturers, American workers and American consumers must themselves provide the means of safeguarding this industry in such a way that its permanence, stability and continuous development is assured.

E. I du Pont de Nemours & Company, Inc.
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Felts and Jackets

for every kind of
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INTENSIVE SPECIALISTS IN THE MANUFACTURE
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FOR THE PULP, PAPER AND BOARD INDUSTRY

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The Most Important Chemical Process in the Paper Mill

56 PAPER MILLS

In the United States and Canada

FIFTY-SIX Paper Mills in the United States and Canada are already free from sizing difficulties. These mills produce 4472 tons of sized paper daily. They use the

De CEW SIZING SYSTEM

Among the many advantages resulting from the use of the De Cew Sizing System may be mentioned:

Improved quality of paper. Uniformity of Product.
Greater resistance to destructive action of heat and light.
Use of less alum. Conservation of rosin.

This System comprises highly developed Processes and Apparatus, including technical features recently perfected. Back of the System is a Service that includes complete examination of water and stock, beating methods, storage conditions and paper machine variables, and necessary adjustment of methods to meet these conditions.

Write for new booklet ***"The Mills That Use—"***

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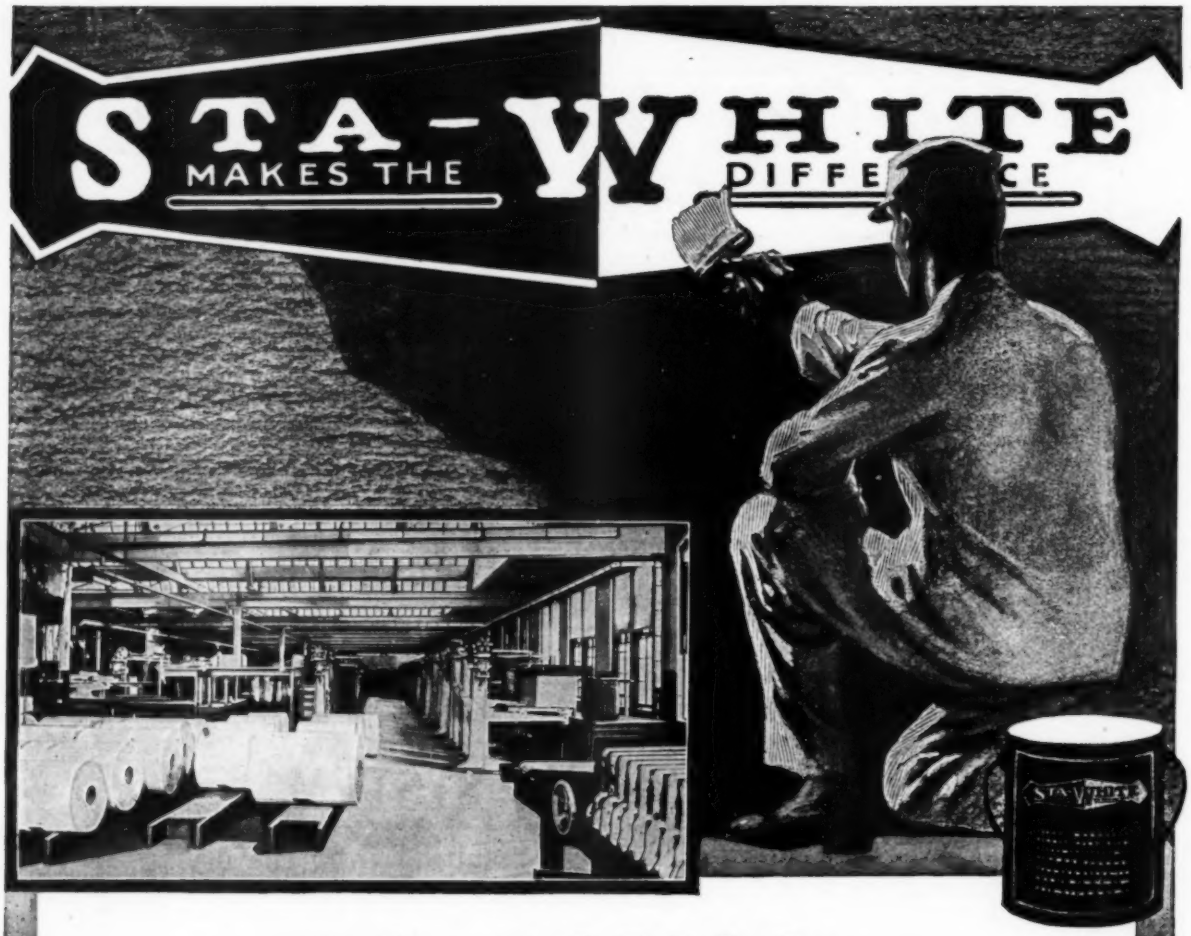

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First Annual Convention of the American Pulp and Paper Mill Superintendents' Association

Held on June 4 and 5, 1920, at the Hotel Statler, Buffalo, New York

THOSE few less than two hundred superintendents, paper mill machinery and supply men who attended the first annual convention and anniversary of the birth of the American Pulp and Paper Mill Superintendents' Association at the Hotel Statler, Buffalo, New York, on June 4 and 5, were privileged to enjoy what the records will show in years to come to have been a great instructive and fraternal event. Coming as it did at a time when all the world is clamoring for more production, the opportunity was granted to these men who superintend the making of paper to discuss more efficient methods for making their product. Conspicuous was the fact that this occasion brought together practically for the first time the paper mill superintendents from the East and Middle West in an exchange of ideas and a cementing of friendships.

Attention was given to the program of the days' sessions and gave vent in the evenings to the spirit of fun, and the dinners of Friday and Saturday evenings proved without a doubt that this was a party of men who could "Work hard and play hard."

Friday Morning Session

Due to the railroad delays many of the men did not reach Buffalo until late on Friday morning and it was 11:40 a. m. before registration was finished and President F. C. Boyce, of the Wausau Paper Mills Company, Brokaw, Wis., called the meeting to order. During the course of the opening address of President Boyce he said the following:

"This is an age of co-operation and service. The manufacturers have their organization, the technical men, the cost men, the salesmen, and the men in the mill, all are organized. Our emblem is the keystone which fitly represents the superintendent in every manufacturing plant, but more especially in paper and pulp mills. John Strange at the Menasha meeting told us that the superintendent was supposed to know something about everything, and his hours of duty were twenty-four hours, and his bed a pile of broke in the mill.

"I do not think that there has been a class of men during the last four years who have had any more trouble than the superintendents. At the time the war started their men were all leaving to go to war. After the war unrest was developed among all classes of workmen and at present when your supplies are all held up and you are expected to keep your production up to top-notch all the time, the life of the superintendent is anything but agreeable. But did you ever stop to think of your moral responsibility to the men who work with you, the chance you have to lead their thoughts along the right lines and make them good, loyal men to the company they work for, and at the same time make them good citizens and good loyal Americans?"

O. L. Berger, of the G. D. Jenssen Company, 200 Fifth Avenue, New York City, read the first paper of the convention, "The Future of Acid Making," a copy of which will be found on another page of this magazine.

In the absence at this time of John E. Daley, general superintendent of the Port Huron Sulphite and Paper Company, his paper on "Mitscherlich Fibres" was read by the secretary. Mr. Daley pointed out that Mitscherlich pulp differs from ordinary quick cook pulp in several characteristics, due principally to the facts that the chips in Mitscherlich pulp are larger, and a lower temperature in the cooking is permitted, owing to the longer time that is given to the cooking of the wood. Another difference between the two pulps comes from the emptying of the digesters. In the Mitscherlich process, the gas is blown off and the digesters are filled with cold water two or three times in order to make it cool enough for men to shovel it out. This cold water makes the fibre much harder, firmer and stronger. With the quick cool process, the fibres are blown out of the digester by pressure, and as the fibre is blown out and comes into atmospheric pressure, it either ruptures, splits open or blows off its ends. Mitscherlich pulp will therefore knit together in a firmer sheet, make a harder paper and have greater strength than quick cook pulp.

A paper on "The Future Wood Supply" was then read by Edward Simonson of Buffalo, N. Y., who covered his subject splendidly, and among other things said that today the manufacturers of pulp and paper face a very serious problem. According to experts, in about twenty-five years, the supply of trees will be exhausted, and that, at present, our own forests supply only one-third of our own wood for news print. He suggested that if we are not to depend on other countries for supplies of wood for paper making, we take steps to see that timberlands are cut properly and that by medium of the vote, a Con-

gress will be elected which will co-operate and work for reforestation.

Dr. Hugh P. Baker, secretary of the American Paper and Pulp Association, was then called upon to make a talk, and in an extempore manner dwelt upon the necessity for reforestation.

The Executive Committee session was called to order at 2:00 p. m. At this meeting, the nomination of officers took place, and deliberation on the amendments to the constitution and by-laws.

Friday Afternoon Session

The open session of the afternoon was called to order by President Boyce, and the first paper read was by Elbert G. Milham, chemist of the Bryant Paper Company, Kalamazoo, Mich. His subject was "Investigation of Raw Stock for Coated Paper." He told how necessary it was that chemists should be able to get along with the men in the mill, and that he becomes almost a worthless adjunct if not permitted to leave his laboraory. He related an incident in his own experience, where it was desired to improve a certain grade of paper without incurring any additional expense. In making an investigation, a lack of co-operation was discovered between the paper-making and paper-coating departments. This was straightened out and tests were made with the result that a more satisfactory grade is now being run.

An interesting paper on "Ground Wood Practice," by John Mulchaey, superintendent of the Flambeau Paper Co., Park Falls, Wis., was read by the secretary.

Mr. C. Burrell, of the Orr Felt and Blanket Company, Piqua, Ohio, read an interesting paper on "The Use and Abuse of Papermaking Felts." He gave a complete account of the manufacture of this valuable article and passed samples of wool yarn and finished felts around through the audience. He spoke of the difficulties involved in the manufacture of felts on account of the great amount of time necessary to produce them, and urged the superintendents to give the manufacturer their orders well in advance of the time that they need them, in order that the proper attention can be given to quality.

"Dye Stuffs and Its Uses" was the subject next covered, by Frank A. Whittiger, of Kuttroff, Pickhardt and Co., Inc., Chicago. He said that the duty of the dye salesman now was to "Help take the load off the superintendent's shoulders." An interesting account of the application of colors then ensued.

Mr. Charles W. Shartle, of the Shartle Continuous Beater Company, Middletown, Ohio, was the next speaker on the program. He introduced his address by relating a number of interesting anecdotes before taking up the subject of "Beating." He also displayed by the aid of the stereopticon a number of tricks in relation to belts which he had discovered during his years in the business, and which he thought might be useful to the men who were present. He offered to send blue-prints to anyone who requested them. A picture was then flashed on the screen of the Brownell Buehler Patented Perforated Back-Fall, and a complete explanation was made of its working.

"The Manufacture of Paper Machine Wires" was the next subject in order, and H. Lindsay, of the Lindsay Wire Weaving Company, Cleveland, Ohio, gave a very interesting and practical account of it. He spoke of the wonderful progress in the paper industry during the past fifteen years, and of how the Fourdrinier wire industry has kept pace. "Not so many years ago, all paper machine wires were made on hand looms," he said, "but today, 95 per cent of them are made on automatic power looms," and today, when wires of two hundred and thirty-two inches in width are demanded, the wire manufacturers are in a position to furnish them. Mr. Lindsay then explained in detail the manufacturing process of a Fourdrinier wire, the packing and boxing of same, and concluded by mentioning some of the things in connection with the abuse of wires that has come to his attention. An open discussion then followed, during which Mr. Lindsay answered a number of questions which were put to him.

A very interesting talk on "The Curling of Fine Papers," by H. H. Hackett, of the Eastern Manufacturing Company, South Brewer, Me., was then delivered. In the present day of automatic paper feeding devices, the prevention of paper curling is absolutely necessary. Temperature and moisture play a big part in the creation of this difficulty. From numerous experiments, many ways have been found to remedy the trouble, among which is a change in hanging the papers.

Friday Evening Dinner

This concluded the day's program and at 6:30 p. m. the dinner and entertainment commenced. A sumptuous array of food took care of the inner man, and the air was filled with laughter and song. A male quartette rendered a lot of good spicy songs and lead the diners in hearty ensemble. Violin and vocal selections were rendered by two lovely young ladies and other song and dance acts followed. A woman then performed some clever tricks with a punching-bag, and to the amusement of all induced A. G. Adams, of Stewart, Adams & Co., Chicago, to try his hand at the bag. Credit for the successful evening is due to Herbert Lippitt of the Brown Company, Portland, Me., who arranged the program and saw to it that everyone had an enjoyable time.

Saturday Morning Session

On Saturday, the convention resumed labor at 10:00 a. m. and the first topic on the program was "The Manufacture of Container Board." Owing to the absence of John Pfister, general superintendent

of the Waldorf Paper Products Co., St. Paul, Minn., who was to talk on this subject, his paper was read by the secretary. He related some of the essentials in the production of boxboard, among which was the necessity of guarding against liners that peel. Data on horsepowers needed to operate paper machines, Jordans and beaters was then submitted, and the article concluded with an expression that superintendents should become more familiar with technical problems.

The next subject on the program for discussion was "Sulphate of Alumina." Mr. F. A. Lane, of the Kalbfleisch Corp., New York City, gave a very interesting account of this substance which is used in the manufacture of satin white, and exhibited a number of samples.

The election of officers for the ensuing year was the next order of business. President Boyce read a letter from a member on the Pacific Coast in which he regretted his inability to attend the convention, but assured the association that he would be at the next one. The following officers were then unanimously elected: President, Fred C. Boyce, of the Wausau Paper Mills Co., Brokaw, Wis.; 1st vice-president, John O'Connell, of the King Paper Co., Kalamazoo, Mich.; 2nd vice-president, Mr. Walker, of the Finch, Pruyn Paper Co., Glens Falls, N. Y.; 3rd vice-president, Nelson Davis, of the S. D. Warren Paper Co., Cumberland Mills, Me., and secretary and treasurer, Peter J. Massey, of the W. F. Hall Printing Co., Chicago.

After the completion of this business, E. N. Huyck, of F. S. Huyck and Sons, Albany, N. Y., read an excellent paper on "Some Problems of the Felt Manufacturer," a copy of which is published on another page in this magazine. An interesting discussion took place on the relative merits of the Mitchel and American jackets. It was conceded that the Mitchel jacket was superior in many respects, but the durability of the American could not be disproved.

J. D. Watson, of the Wisconsin Wire Works, Appleton, Wis., gave an exceptionally good talk on "The Manufacture and Use of Paper Machine Wires," and spoke of brass being the best metal to use owing to its elasticity. He hopes before long to see wire mesh standardized.

This address concluded the morning session and everyone gathered in front of the hotel to have their picture taken, after which, a buffet lunch was served on the mezzanine floor before starting the afternoon session.

Saturday Afternoon Session

"Industrial Peace" was the subject of an interesting and instructive address delivered by Frank L. Glynn, who is on the industrial commission of the State of New York. The speaker had his subject well in hand. He touched upon the service a superintendent can perform by helping the advancement of the workers and encouraging them to learn, and by so doing, assist in bridging the chasm between capital and labor.

The repetition of an illustrated lecture given at the last Northwestern Division meeting in May entitled "Perfecting of a Printing Plate," by L. A. Claybourn, of the Menasha Printing and Carton Co., Menasha, Wis., was then given. In the rotary multi-color process of printing, all colors are printed at the one time, which is a far more rapid method than the old system of printing one color at a time. Since all the plates print on the one impression cylinder, they must be made to print without any makeready. Consequently, specially designed electrotype machinery has been perfected and patented by Mr. Claybourn and can be set to alter the thickness of a plate as low as one-quarter of one-thousandth of an inch. Uniform thickness of paper is very essential, and since the growth of carton printing has become so enormous, the need of devices which will automatically preserve a uniform thickness in the manufacture of board is certainly apparent.

Al. Kroes, of the Employers' Mutual Liability Insurance Co., Wausau, Wis., gave an illustrated lecture on "Safety First." Handicapped as he was by a poor lantern-slide operator, he put his story over the "home-plate," nevertheless. Since safety is something which cannot be seen, people have been slow to comprehend the subject. Through untiring efforts of safety engineers in the last few years, however, the necessity for safety appliances and habits in manufacturing plants is becoming more appreciated.

"Air Conditioning for Paper Mills" was the subject of the next address by J. O. Ross, of the B. F. Sturtevant Co., Boston. This very important matter which is of so great concern to paper makers was treated in a thorough manner, and it was shown that to rid air of moisture, it must be gotten below its normal temperature; heat increases its moisture capacity.

Mr. J. Stewart, of Stewart, Adams & Co., Chicago, delivered an interesting talk on "Paint Consumption." He spoke of the necessity when ordering paint to specify carefully the kind of job for which it is wanted. In personal experiences, he has often seen the wrong kind of paint used simply because the paint manufacturer had no knowledge of the condition of the surface to be painted.

This address completed the program of discussions. Resolutions were then unanimously passed to the effect as follows:

Resolutions Passed

Mill superintendents should spread reforestation propaganda, and the association desires to forward and support the policy of reforestation as de-

cided upon by the American Paper and Pulp Association.

Thanks be extended to the City of Buffalo, the Association of Commerce and the hotel management for the kindness and hospitality extended to the superintendents while they were there.

Thanks be extended to the committee on arrangements for their untiring efforts in making the convention a success.

Credit is due A. G. Adams, of Stewart, Adams & Co., Chicago, and many others for being so serviceable.

The session adjourned at 5:00 p. m. and the business of the convention came to an end.

Saturday Evening Banquet

At 7:00 p. m. the diners were seated at the banquet tables. Ensemble singing was indulged in during the courses and everyone loosened up for an evening of joy. A group of exceptionally good cabaret artists kept winding in and around the tables, dancing and singing. The last course served, President Boyce introduced Roy Crandall, advertising manager of the Buffalo General Electric Co., of Buffalo, who thereafter took charge of the banquet. In his introductory remarks, which were full of witticisms and anecdotes, he referred to the importance of paper making. Brief talks were made by the newly elected officers and the toastmaster then called on James Harrigan, of the Harrigan Lumber Co., of Buffalo, who immediately made a sensational hit as a relator of stories.

H. H. Hackett, of the Eastern Manufacturing Co., South Brewer, Me.; H. W. Server, of the Miami Paper Co., West Carrollton, Ohio; C. T. Jewell, of the St. Regis Paper Co., Watertown, N. Y.; F. W. Claybourn, of the Menasha Printing and Carton Co., Menasha, Wis.; and Al. Kroes, of the Employers' Liability Insurance Co., of Milwaukee, Wis., were other speakers of the evening.

Following is a list of those who attended the convention:

J. A. Stewart, Stewart Adams & Co., Chcago.
L. F. Murphy, Auglaize Box Board Company, St. Mary's, O.
H. A. Radford, Process Engineers, Inc., 501 Fifth avenue, New York.
Charles E. Hayden, C. E. Hayden Mill Supply Company, Springfield, Mass.
J. B. Wilt, Parsons Pulp and Lumber Company, Parsons, W. Va.
A. G. Adams, Stewart Adams Company, 549 Washington street, Chicago.
W. A. Anderson, Kinleith Paper Mills, St. Catharines, Ont.
M. J. Argy, Cliff Paper Company, Niagara Falls, N. Y.
William J. Argy, St. Regis Paper Company, Black River, N. Y.
Dr. Hugh P. Baker, secretary-treasurer American Paper and Pulp Association, 18 E. 41st street, New York City.
F. K. Becker, Bird Machine Company, Walpole, Mass.
J. S. Beeson, Hoover, Owens, Rentschler Company, Hamilton, Ohio.
Bernard Benson, Bulkley Dunton & Co., New York City.
J. Biersdorfer, Imperial Belting Company, Chicago.
George Ernest Bradley, Alex. McArthur & Co., Joliette, Que.
L. H. Breyfogle, Draper Brothers Company, Kalamazoo, Mich.
J. L. Brown, Imperial Belting Company, Chicago.
F. E. Brown, Waterbury Felt Company, Skaneateles, N. Y.
O. L. Berger, G. D. Jenssen Company, New York.
J. A. Bowers, Hammermill Paper Company, Erie, Pa.
N. M. Brisbois, Sutherland Paper Company, Kalamazoo, Mich.
F. C. Boyce, Wausau Paper Mills Company, Wausau, Wis.
Thos. A. Burbank, Cornell Wood Board Company, Cornell, Wis.
E. D. Burgess, Garden City Paper Mills, St. Catharines, Ont.
W. H. Burns, Valley Iron Works Company, Appleton, Wis.
W. C. Burrell, the Orr Felt and Blanket Company, Utica, N. Y.
James L. Carey, 208 N. Lavarnie avenue, Chicago.
O. T. Chalon, Kuttroff Pickhardt & Co., New York.
H. B. Chandler, U. S. Rubber Company, Syracuse, N. Y.
Philip B. Chase, Goodyear Tire and Rubber Company, Buffalo, N. Y.
Fred Cherrie, Castle Gottheil & Overton, New York.
F. W. Clayburn, Menasha Printing and Carton Company, Menasha, Wis.
William Coombs, New York.
John P. Corey, Ypsilanti, Mich.
M. J. Cornell, Carthage Sulphite Pulp and Paper Company, Carthage, N. Y.
E. H. Cornell, Graton and Knight Manufacturing Company, Chicago.
John Cornell, New York.
Edward T. A. Coughlin, Monarch Paper Company, Kalamazoo, Mich.
R. J. Cunningham, Northern Paper Mills, Green Bay, Wis.
J. E. Daley, Port Huron Sulphite and Paper Company, Port Huron, Mich.
D. B. Davis, Munising Paper Company, Munising, Mich.
Leon K. Deturler, Diamond State Fibre Company, Norristown, Pa.
A. Scott Dowd, Chicago, Ill.
Frank B. Eilers, Eilers Mill Supply Company, Kalamazoo, Mich.
John W. Edson, Hollingsworth & Vose, East Walpole, Mass.
W. F. Ebbing, the Ohio Knife Company, Cincinnati, Ohio.
William F. Fogarty, Northern Paper Mills, Green Bay, Wis.
Cale B. Forsythe, Cale B. Forsythe Company, Kalamazoo, Mich.
E. W. Frazier, Voorhees Rubber Manufacturing Company, Jersey City, N. J.
Cyrus E. Frye, Lincoln Paper Mills, Elkhart, Ind.
E. H. Gilman, Bryant Paper Company, Kalamazoo, Mich.
E. B. Fritz, Chicago.
Weston W. Goodnow, Fort Orange Paper Company, Castleton-on-Hudson, N. Y.
H. M. Grady, Cliff Paper Company, Niagara Falls, N. Y.
W. D. Gregor, Arrowhead Mills, Fulton, N. Y.
John H. Hays, the Waterbury Felt Company, Skaneateles, N. Y.
H. H. Hackett, Eastern Manufacturing Company, South Brewer, Me.
L. B. Hanchett, Machinery Company of America, Big Rapids, Mich.
Thomas F. Heberly, Schmidt & Ault Paper Company, York, Pa.
John Hercher, John Strange Paper Company, Menasha, Wis.
Lewis E. Housley, Voorhees Rubber Manufacturing Company, Jersey City, N. J.
J. Hubert, Abitibi Power and Paper Company, Iroquois Falls, Ont.
C. T. Jewell, St. Regis Paper Company, Herring, N. Y.
Geo. B. Johonnot, Toledo Scale Company, Toledo, Ohio.
J. Louis Jordan, Brown Company, Portland, Me.
Henry Josephs, Daniels Manufacturing Company, Rhinelander, Wis.
Harvey N. Jurgensen, Itasca Paper Company, Grand Rapids, Minn.
W. A. Kelly, Marathon Paper Mills Company, Rothschild, Wis.
C. H. Kent, Paper Makers Chemical Company, Holyoke, Mass.
Kenneth T. King, DuPont Dyestuffs Company, Chicago.
Peter King, Castle, Gotthiel & Overton, Kalamazoo, Mich.
Samuel Klein, Calco Chemical Company, Bound Brook, N. J.
Al Kroes, Employers Mutual Liability Insurance Company, Fond du Lac, Wis.
Frank A. Lane, the Kalbfleisch Corporation, New York.
R. J. Lawrence, Western Paper Makers Chemical Company, Kalamazoo, Mich.
George J. Lenz, John Hoberg Company, Green Bay, Wis.

(*Continued on page 470*)

Principles of Belt Selection and Use

By JAMES B. McPHERSON
The B. F. Goodrich Rubber Co.

MOST of the trouble experienced by users of transmission belt is entirely unnecessary, and is usually the result of trying to put a square peg in a round hole. The selection of type and ply is often left to guesswork, and the result is premature wearing out of the belt. Extreme care should be exercised in the choosing of a belt, and a few simple fundamental principles should be followed. Much has been written on the subject, and yet experience shows that these lessons must be repeated and rewritten. Every new belt means expense, and in fairness to themselves, belt users should know how to get the maximum life and work out of any belt.

The ability of a belt to transmit power depends upon the grip of the belt upon the pulley. This grip is dependent upon the friction between the materials of which the belt and pulley are constructed. When the coefficient of friction is low, the result is excessive slip. The coefficient of friction for rubber on iron is approximately .25; of rubber on rubber, it is .35. When the coefficient of friction is low, and there is excessive slip, common practice is to increase the tension. But this is bad practice; lagging the pulleys with rubber will increase the grip of the belt on the pulley, and eliminate much of the slip.

Arc of Contact

The arc of contact is of equal importance to the coefficient of friction as a factor affecting the grip of a belt on the pulley. The greater the arc of contact, the greater the grip. It is evident that the arc of contact should be as large as possible, in order to secure a larger gripping surface on the pulleys. In order to secure this greater arc of contact, the use of snub pulleys is sometimes necessary. The snub pulley should be applied at the proper point to hold the belt against the pulley over a greater arc, and on the pulley that has the smaller arc of contact. But the snub pulley, like chains on a tire, is a means of overcoming a deficiency that cannot otherwise be conquered. It is a substitute for a properly designed installation with the proper arc and with a belt of sufficient width to carry the load. It usually makes necessary an endless belt, and sets up additional internal stresses. It is far more desirable to have the drive designed so as to give the best arc of contact, or, this being impossible, of sufficient width to procure a maximum gripping surface.

Initial Tension

The initial tension that is applied, is allied to coefficient of friction and arc of contact as affecting the power that can be transmitted. Without entering into the technical relations and values of tension, it will suffice to say that, were there no initial tension, there would be no grip of the belt upon the pulleys. Going to the opposite extreme, tension could be applied until either the belt breaks, or the pulley shaft springs. Somewhere between the two is the ideal tension for properly transmitting the necessary power, which good rubber belt practice has demonstrated to be about ten pounds per ply per inch of width. Excessive tension leads to undue strain upon the belt, thus shortening its life in service. It also leads to excessive journal friction, and overheated bearings. Not only is actual damage done, but the added power necessary to merely turn the driving and the driven shafts under this excessive pressure, is wasted. When the belt is in operation, the tension on the tight side naturally increases to the extent of the power transmitted (effective pull or horsepower tension), plus the initial tension. The total tension is equal to the initial tension plus the horsepower tension. Total tension should not exceed twenty pounds per inch of width per ply for ideal conditions.

Summing up these three points then, for ideal power transmitting conditions, we must secure (a) the maximum coefficient of friction, (b) the maximum arc of contact practicable, and (c) the proper initial tension. These can be obtained, briefly, (a) by lagging the pulleys, (b) by the use of snub pulleys if absolutely necessary, or installing the belt with the tight side on the bottom of the drive (in which position the natural sag then increases the arc of contact rather than decreasing it), and (c) by applying an initial tension not to exceed about ten pounds per ply per inch of width. The maximum speed for effective operation is about 5000 feet per minute; greater speeds than this produce a centrifugal effect, which impairs the grip of the belt upon the pulleys. The face of the pulleys should be about two inches wider than the width of the belt. The best center to center distance for drive belts is from 20 to 25 feet, on horizontal drives. Vertical drives are to be avoided, because of the high initial tension necessary to hold the belt in contact with the lower pulley; where vertical drives are avoidable, the centers should be as short as possible.

Rubber Belt Troubles

The most common causes of rubber belt troubles are the practice of blindly increasing the tension until the bearings groan, or smearing on belt dressing of unknown ingredients, many of which are injurious to rubber belts, or using belts that are too heavy or wide for the pulleys. Carelessness in fastening frequently

ruins belts, especially where rawhide lacings are used; the ends should be square and lacing tension should be even across the belt. Running the belt on "cross cones" will curl the edge of a belt, stretch it along one side, and separate the plies. The edge should never rub against the next step of a cone pulley, or anything else.

We may now consider some factors which affect the belt, but which are principally matters of machine design. Normally, a belt manufacturer must recommend a belt to fit conditions that already exist; as for example, the pulleys are already installed, the speed must be a certain rate, and the horse-power to be transmitted is fixed. Machine designers, knowing these conditions, should know the number of plies necessary to do the work, and should allow four inches of pulley diameter for each ply of transmission belt. Continuous bending of a heavy belt over a pulley that is too small sets up within the belt excessive strains and internal friction that were not considered in their design. But knowing the conditions that exist, the belt user should be able to prescribe the belt best suited to those conditions.

Formulas

At this point, we will consider a few simple formulas. We recognize that the power transmitted by any belt depends on the working tension and the velocity at which the belt moves. We recognize that the working tension is limited by the strength of the belt in tension, and this, in turn, depends on the width and thickness. It is logical to expect then that a certain size belt running at a certain speed, can transmit a definite amount of power. Experience has demonstrated that the following rule checks up with good average practice: **"A four ply belt 1" wide, running at 800 ft. per minute can transmit one horse-power."** Using this rule as a basis, we can by direct proportion, determine the horse-power that any other belt will transmit, or the proper number of plies, or the width, if we know the horse-power to be transmitted, and the speed of the belt.

The following formulas are deduced from good average practice; they will be found useful to the practical man, and are stated without going into their derivation, which would add needlessly to the length and complexity of this article:

The maximum tension in a belt is found by multiplying the horse-power by a constant. This constant varies with the conditions. The results of the formula will be in pounds.

T max = 600 x HP, for bare pulleys.
" = 500 x HP, for lagged pulleys.
" = 400 x HP, for tandem pulleys.
" = 330 x HP, for lagged tandem pulleys.

The following formulas will probably answer any question that may be raised about any drive, and will enable a user to determine if his belts are properly selected; they are particularly handy because of the ease with which they can be juggled to obtain any factor:

Where HP = Horse-power.
P = Plies.
W = Width of the belt.
D = Diameter of either pulley **in inches.**
N = R. P. M. of the above pulley.

$$HP = \frac{PWDN}{12000}$$

and

$$P = \frac{12000\ HP}{WDN}$$

and

$$W = \frac{12000\ HP}{PDN}$$

Special drives, such as crossed drives and quarter or half turn drives, involve special principles, which will not be considered in this paper.

Lacing

Presuming now that the proper belt has been chosen for a given drive, the next feature to be considered is lacing. Great care should be taken that fasteners are chosen that will grip the warp threads, rather than cut through them and weaken the belt. After all, a belt is only as strong as its weakest point. That point is at the joint. It is safe to say that no laced belt will show a tensile strength equal to 75% of the tensile strength of the belt itself. That fasteners are successfully used is due to the fact that belts are operated with a large safety factor, and the fastener is never called upon to exert a tensile strength equal to that of the belt.

Great care should be taken that mineral oil does not come in contact with rubber belt. Its action is injurious. It should also be remembered that a rubber belt is about the only thing in life that should show the seamy side! We usually try to hide the seamy side; but don't do it with a rubber belt! The smooth side should be run next to the pulleys.

There is nothing new or startling in this article, it is simply a presentation of information that may enable a few belt users to overcome some of their difficulties.

Kerosene oil around a power plant is a very handy thing to have. Cracks or flaws in smooth metallic surfaces can be found easily by moistening the surface with kerosene and then rubbing and drying with a clean cloth, after which the surface should be covered with chalk. The location of the flaws will then be revealed by the kerosene coming out again from the cracks into the chalk covering.

The best method to change the speed of a Corliss engine is to pulley the governor so that it will run at the old speed, the speed for which it is intended. A departure from this speed will keep it against one or the other of its stops.

Some Problems of the Felt Manufacturer

By E. N. HUYCK
Pres. F. C. Huyck & Sons

Presented at the Convention of the American Pulp and Paper Mill Superintendents' Association, at Buffalo, New York, June 4-5, 1920

IT is a great privilege to be asked to present to such a representative body of executives of the paper industry some facts about one of the essential supplies of paper and pulp machines. I am not going to attempt a comprehensive statement either of the making or use of felts, but to tell you something of our own problems and suggest for your consideration other problems in which we need your help.

When paper manufacturers visit a felt mill for the first time, their strongest impression, I think, is one of surprise at the amount and variety of machinery necessary to make felts and the great number of operations required to convert raw wool into the finished product. I have heard papermakers say they had a vague idea that wool was fed in one end of a machine and came out the other a finished felt (or all finished but the joining) in some such way as paper is made. After watching the successive operations, they have expressed quite a different understanding of the difficulties of making a satisfactory felt and of the necessity for the greatest care.

For more than a hundred years, wool has been used for making felts for paper and pulp machines, because it has the property when woven into a soft loosely constructed fabric of allowing the water in the paper to be pressed through it very readily. Just what is the office of a felt; does its act chiefly as a filter or as a blotter? Does most of the water pass through the holes between the threads or through the threads themselves? Does the felt in use deteriorate, first because of friction and abrasion—is it a mechanical process or do the fibres suffer a chemical change first which so weakens them that they wear more easily? What is the chemical action on the wool fibres of the water in which it is constantly run on a paper machine, especially if the water is warm? If this action harms the wool, how can it be retarded? What effect do acids and alkalis, colors, clays, sizing have on felts? What is the relative porosity of various weaves and designs of felts, and what is the relation of porosity to speed? These and many other problems will be solved, I hope, by research laboratories, the importance of which we are just beginning to realize.

No doubt, you have your own troubles with variations of your raw materials, but it seems to me that you could not possibly have the variations that the felt manufacturer has in his wools.

A good many years ago, my father was visiting a paper mill and said to the proprietor—who was standing near him by the machine—"You have a very satisfactory business, it is clean and simple, you run your entire product through this machine, it comes out in rolls and you ship it and have no further trouble." The reply was: "Young man, every one knows the miseries of his own business best." I am not going to tell you of the miseries of the felt manufacturer—you have probably heard of them already.

Careful Selection of Wool

Wool is grown in almost every corner of the earth, and its character changes with the climate and soil and the condition of the sheep. Not only is the wool of one country different from that of another, but in a country as small as England, there are dozens of varieties of wool absolutely different in character. Moreover, wool from the same section, or even from the same farm, varies in its condition from one year to another, and to carry the comparison to its limit, the wool of one sheep is never exactly like the wool of the next one in the same flock. It is only by the most careful purchasing of graded fleeces from the same section of country and subsequent sorting into several different qualities and blending with the greatest care that uniformity can be obtained.

One thing I want you to believe because I know it is true; that is, that every felt manufacturer buys and uses in his felts the wool which in his judgment is the very best for the purpose. When a felt goes wrong, and for some unexplainable cause, the nap wears off quickly or the threads break, the paper manufacturer is apt to say "there is poor wool in this felt" or "the felt maker is using shoddy." The felt maker never has and never will use shoddy, because it would be suicidal. It is difficult enough under the best conditions to make felts that will run satisfactorily, and the competition on quality is so severe that you need never fear anything more serious than mistakes in judgment as to the wools that are used or, as in the time of the war, the impossibility of obtaining the wools that the manufacturer would like to use. Felt manufacturers are competing today with each other and with other woolen manufacturers for the purchase of the longest stapled, strongest, cleanest wool grown.

Fifty years ago, when the average size of a cylinder wet felt was about 27′ x 50″ and the chief product of cylinder machines was straw wrapping paper, and the average size of a Fourdrinier wet felt was about 24′ x 72″ and of a second press 12′ x 72″,

the problems of a felt manufacturer were not so much to make the felts open or to stand high speeds as to perfect the mechanical construction of the felt so it would run straight on the machine without slack edges and without wrinkling and would not narrow up. I remember that when I first started in the business, over thirty years ago, these were our chief problems. Wider machines were then coming into use, and higher speeds were being accomplished. A story that for three hours one of the machines at Parmers Falls had run at a speed of 253 feet was at once emphatically denied as an impossibility.

Strength and Elasticity

On one of the first wide machines built, the size of the first felt was 29′ x 172″. I remember very well the tendency of these felts to wrinkle in the center. I am sure there are other felt makers who would remember this just as distinctly. We hear very little today of such troubles and I think it is due not only to the fact that felt making machinery and methods have been greatly improved, but also to the fact that paper machines have been just as greatly improved in facilities for handling felts. I have never ceased to be surprised, in watching felts running on great Fourdrinier machines or Cylinder machines, at the fact that they can run under the extreme speeds and heavy work required of them for days or weeks instead of running off the rolls, tearing or wearing out in a comparatively short time. Felts to perform their service, and to allow the water to pass through freely, must be woven so loosely and made so open that although sometimes they are required to do almost the work of a leather belt, they seem a comparatively frail fabric, but they possess much greater strength than one at first realizes. From tests in our laboratory, we find that bottom board felts for use on multiple cylinder machines have a breaking strength of about 100 lbs. per inch per width or a breaking strength of 10,000 pounds for a 100″ felt. This felt cut from the edge, however, might rip quickly all the way across with very little force applied to it. You probably know of cases where in attempting to tear off the edge of a felt, while it is under a strain on the machine, it has been cut in an inch or two from the edge and has quickly torn straight across.

There is no other fibre that equals wool in its elasticity, and while this is in many ways a help in manufacturing felts, it also presents a very difficult problem to the felt manufacturer, because, while he must take advantage of it in certain ways, he must also govern the elasticity in such a way that the felts when put on the machines will hold their width and length. If the felt is made too tight in length, it will shorten up and become too close. If there is too much elasticity, it will stretch out indefinitely and on this account give much shorter service.

I think I can say with certainty that felt manufacturers in the United States have always endeavored to keep up with the progress of the manufacturers of paper. As machines have grown larger and heavier and speeds have increased, and as the demand has come for felts of greater widths and greater lengths, the paper machine builders have never been hampered by any failure of felt manufacturers to be able to produce felts to fit the machines. The only limitation that I ever remember having been given to manufacturers of paper machines is that felts for fast running Fourdrinier machines should not be over 65′ in length, as otherwise they could not be made seamless.

It has not always been easy to give this assurance of capacity for meeting any requirements, and it has only been possible for us through making some of our own machinery, and through very strenuous efforts to induce machinery manufacturers to meet our special requirements. The industry is not a large one and it has been very difficult to induce manufacturers of looms and other machinery to do the experimental work necessary to produce machines with the weight and size required. The reply has often been—if you had an order for hundreds of machines of this kind it would pay us to experiment, but, for three or four or a dozen, we cannot afford the experimenting, and you will haye to take what we are now building and make it answer your purpose. Looms over 400″ wide, fulling mills to carry 1,200 pounds weight of cloth, napping machines 300″ wide, dryer cylinders over 240″ wide present problems which have not only made machine builders hesitate, but have necessitated the rebuilding or designing of felt mills to provide bays of sufficient size to hold these big machines.

Conservation of Felts

When the Papermakers' Felt Industry was taken in charge by the War Industries Board under the Felt Section of the Woolen Division, a War Service Committee of the felt makers was formed, and, under the urgent necessity of saving wool, suggestions for the conservation of felts were formulated by this Committee. These were afterwards submitted to the Conservation Section and the Paper Section of the War Industries Board, and finally put in shape for submission to all paper manufacturers. These suggestions, I believe, cover the ground very thoroughly, and, as they are no doubt in the files of all paper manufacturers today, I would like to suggest that you read them over frequently and then have them read over by your foremen and the men who handle your felts.

I know of paper mill superintendents who have held regular meetings with their foremen and machine tenders at which the subject of the use of felts has been discussed and special rules formulated

to be followed in their own mills. This has been productive of excellent results.

Sometime ago, an article was printed in a trade journal by Mr. B. Denver Coppage on "Felt Foes." This has been reprinted and circulated among paper manufacturers, and I would suggest frequent reference to this also. Many of the felt manufacturers have sent out printed lists of excellent suggestions for the use of felts, and, as you know, articles on similar subjects frequently appear in the trade journals. There are one or two things, however, that I would like to suggest for your consideration.

I remember that in one of Richard Harding Davis's stories, the hero gets into a street fight, and, as three or four men rush at him from the darkness, he remembers that a prize fighter once told him there were several rules to be followed in a street fight, but he had forgotten all but one—that was to hit first. There are a good many rules for the use of felts, but if you were to forget all but one, and follow that, the ground would be pretty thoroughly covered. This rule is—see that both your felts and paper machines are kept in the best possible condition. You would be surprised at the number of felts that come to our attention during the year ruined by two causes—moths and mildew. Especially was this so during the war when paper manufacturers, fearing a shortage, carried large stocks of felts. Extreme dampness or moisture in contact with a felt, especially if it is placed in such a way that the circulation of air is cut off, very quickly produces mildew that rots the fibre. Moths thrive on felts that are dirty. Clean, dry felt rooms kept in good order with plenty of moth preventative will pay for the cost of construction and supervision many times over.

Mr. Braman, the Secretary of our Company, and I were in Japan last year, and we found paper manufacturers there very much worried over the large stocks of felts that they were carrying, due to the war conditions existing over there also. They not only feared damage from moths and dampness, but they thought their felts would deteriorate with age. We were able to reassure them on this latter point by citing frequent experiences of felts that we had had in stock for several years, carrying them for odd sizes or qualities, that had given unusual service when finally sent out to some mill in case of emergency.

Machine conditions are always a most serious problem at times like these, when production is being pushed to the very limit or beyond. I know of mills—I am sure that you all do—where felts are not running much over 50% the length of time they were when it was possible to give more care to the upkeep of those parts of the machines having relation to the running of felts. The difficulty of getting renewed parts, such as press rolls and felt carrying rolls, and the lack of time for repairs, makes a very marked addition to the felt bills of paper mills.

Care of Jackets

I want to say a word about jackets. The War Industries Board statement said: "Use care in handling jackets. They are tough and strong, but that is no reason for rough treatment." And yet I venture to say that jackets do get rough treatment in most mills. It is so easy to remedy some little trouble by screwing the guard board down tighter. How many machine tenders stop to consider the pressure that is being applied? In one mill not far from here, the length of service of the same make of jackets was increased from about twenty days to about ninety days by the simple plan of beveling the edge of the maple guard board to a width of 1/16 of an inch at the edge, and keeping it so by redressing it every week. With this thin edge, it was found that little pressure was needed to keep the jacket clear from stock, and dry. I suggest your giving this a trial.

I do not know if it is any more difficult to determine the exact cause when a felt or jacket goes wrong or fails to give the desired service on paper machines, than it is to find the cause of any other trouble in your process of manufacture, but we meet so many cases that puzzle us, and we know that all felt manufacturers do, that we are trying harder than ever to determine the causes of the trouble when called to our attention. I think you will find all felt manufacturers today more eager than ever before, not only to determine the causes of trouble, but, where these causes have been due to anything that can be corrected in running conditions, to assist the paper manufacturer in finding out the remedy; because we realize that it does not do any particular good to determine the cause of the failure of a felt unless immediate steps are taken to prevent its recurrence. We believe there is a great field for work along these lines, and we are trying to do everything we can through our own research laboratory and other outside assistance to accomplish results that will be beneficial to our customers, as well as to ourselves, and we know also that other felt manufacturers are working along these same lines.

Mixed Felts

You may have seen in a trade paper* a report of a test made by the Bureau of Standards at Washington of two felts—one of which contained a proportion of cotton. This test was made at our request of felts supplied by us, in an endeavor to determine if cotton in a felt injured it for its purpose; in other words, whether paper could be couched on a felt containing cotton. While the test proved that cotton did not interfere with the working of the felt, it did not show any advantage gained from it. Following this experiment, we have made a

*The Paper Industry, March, 1920.

number of felts with cotton warp which have been tried on various kinds of paper and pulp. This was not done in an endeavor to cheapen the felt, as with the present very high price of cotton and the smaller value of the used felt as waste material, there is no economy in cost at the present time, but in an endeavor to see if the cotton warp possessed any special advantages over a woolen warp.

We knew that for certain purposes, as, for instance, on asbestos papers, cotton warp seemed to possess a decided advantage.

Our experience has shown that cotton warp felts could be made for use on wet machines running groundwood, that will run satisfactorily. On the contrary, felts which presented a very good appearance when run on Fourdrinier machines did not prove satisfactory. They showed that under running conditions on these machines when wet up, the cotton became hydro cellulose and the stock showed a tendency to stick to it.

I am mentioning these experiments because I think you may be interested to know about them. We have not reached any definite conclusions that are final, but our experiments are continuing. We are trying, as other felt makers are, to produce felts that will be stronger, more open and that will give better service under the most severe conditions. These experiments will be made through our research laboratory, but in any tests under working conditions we shall, of course, need your help and co-operation.

Standardizing Sizes and Qualities

Until very recently, so far as we know, not the slightest attention has ever been given by felt makers or paper machine makers to the desirability of standardizing the sizes and qualities of felts. You use Fourdrinier wires of different meshes for different conditions, but otherwise, I think, wires are the same in design, and it is my impression that while wires are of different lengths there is not nearly so much variety as there is in the length of felts. The same thing is true of canvas dryers. You use dryer felts of different weights, but the standard of designs is the same. In felts, however, it has been customary to make variations in qualities whenever a felt maker or a paper manufacturer thought some little change in design would be of benefit, and there has been no attempt whatever to standardize sizes. The result is that the making of felts has come to be almost like that of custom made clothing, each felt has to be made to fit a certain machine, not only in size, but in style or design to suit the supposed conditions under which it is to be run. This practice has grown up so gradually, and those of us who have been in the industry for a good many years have become so familiar with these conditions, that serious thought of being able to remedy them has never occurred to us.

Two years ago, Mr. H. M. Ashby came to our Company as Executive Manager, and with an experience in a large industry where the value of standardization had been demonstrated, he at once began to inquire if such a variety of designs and sizes was absolutely necessary. Through his efforts, a committee has been appointed by the felt manufacturers which now has this matter under serious consideration, and is working out a plan which will later be submitted to paper manufacturers and paper machine builders. I do not wish to anticipate the work of this committee, but take advantage of this opportunity to present the matter for your consideration, as I feel the recommendation of this committee will prove of great advantage, not only to the felt maker, but to the paper make and the builder of paper machinery.

We were very glad to hear a short time ago that one of the large builders of paper machines in this country was designing a number of fast running machines each with four presses, each machine a duplicate of all the others, and the sizes of all the felts exactly the same both for length and width. I am sure that your own efforts in standardizing paper have been sufficient to make you sympathetic with any similar efforts on the part of felt manufacturers, and that when a plan that seems feasible and reasonable is presented to you, it will have your support.

The necessity for co-operation during the war proved a strong incentive to the felt manufacturers of this country to work together for the good of their industry, and for better service to the paper industry, as they had never worked before, and I know that I can assure you of the keenest desire on the part of all of them to help in your problems in relation to felts, and to meet the new conditions that are arising through the rapid speeding up of paper and board machines, and through the increasing width and length of felts required. The thousand foot machine is going to present new problems to the felt manufacturers just as they have been presented by board machines making over a hundred tons a day, but I think you will find the felt manufacturers not only ready to do their best, but to give to the paper industry intelligent, interested co-operation which will merit your approval.

The control of the flue dampers for each individual boiler should be located at the front of the boiler setting so that quick and easy adjustment can be made for variation in loads. Damper operating mechanism poorly arranged or located in the rear of the boiler setting is very seldom adjusted by the firemen.

Shoe dealers do not give reductions on broken pairs of shoes—you might just as well keep both feet, says the National Safety Council.

A Portable and Universal Instrument for Measuring the Flow of Fluids

By CORNELIUS WEBER
With Vaughn & Meyer, Milwaukee, Wisconsin

IN the work of analyzing power plants and costs of energy, it invariably develops that a full knowledge is necessary of what is happening in the various pipe lines, and especially the steam lines, both the live and the exhaust. To obtain this knowledge, steam flow meters are pressed into service, and a graphic record, as well as a summation of the total quantity of steam flowing in a given pipe, is obtained. Where time, portability and universality are of no consideration in obtaining the knowledge of flow, not mentioning inaccuracies which may arise with varying pressures in a given pipe, such measuring is quite satisfactory.

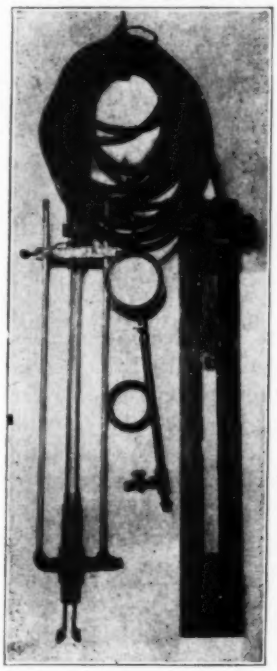

Fig. 1

The writer in his work has been confronted with the problem of steam and other fluid flow measurements, wherein it is necessary to take into account, not only varying pressures, but pipe characteristics as well, and where portability and universality, that is, adaptability to any size of pipe, are of great importance, and where the instrument used can be connected or disconnected at will without interrupting the operation of the pipe in question.

A careful investigation led to the conclusion that the well known Pitot tube offered a good solution, and the measuring outfit shown in Fig. 1 was designed, and consists of a universal Pitot tube, with a pressure gauge and manometer to complete the equipment.

The Pitot tube itself consists of two ¼ inch brass tubes, on the lower ends of which are attached the nozzles shown in the illustration. The brass tubes can be turned about their axes and can be moved in or out through the stuffing boxes by adjusting the yoke up or down on the guide rods, to which it can be secured by the winged nuts, which serve to lock the yoke in position. Collars on the brass tubes secure the tubes to the yoke.

The upper collars have notches cut in them, into which fingers on the ends of the springs fit snugly, and these serve to hold the tubes from turning about their axis when measurements are to be made. The notches in the collars are so placed that when the fingers are in these notches, the nozzles point in opposite directions, in order that one nozzle may point up stream, and the other down stream.

When the fingers are disengaged from the notches in the collar, the tubes and nozzles can be turned and the nozzles fold upon each other, allowing the latter to pass with ease through a one inch pipe or gate valve.

The upper ends of the brass tubes communicate through high pressure air hose with a manometer enclosed in a wooden frame, into which slits have been cut to make the two legs of the glass U tube, enclosed within, readily visible. A differential scale, with a runner, pointer and hair line, allows of accurately reading the liquid column in the glass tubes.

The steam pressure gauge can be attached at the point shown in illustration. When measurements are to be made, a one inch nipple and gate valve are attached to the pipe in which it is desired to make a flow test. Such pipe and gate valve are put on by the operators of the power plant, upon instructions previously issued, and must of necessity in paper mills be made on a Sunday, after shut down. Several such taps in various pipes can be made for various measurements, for the instrument can be attached or detached at will.

With the nozzles folded upon each other, the instrument is screwed to the gate valve. The gauge and siphon are attached, and the small gauge cock is opened. By means of a rubber bulb and hose, water is injected into the hose through the pet cocks, until all air is expelled, and solid columns of water communicate between the nozzles and the mercury, or other suitable liquid in the manometer. The various cocks are closed and the gate valve opened entirely. The nozzles are now pushed into the center of the stream flow, and turned in such manner that one points up stream and the other down stream, whereupon the liquid column in the manometer will deflect.

From the well known fundamental formula $V=2gh$ where V represents velocity in feet per second, h deflection in feet of the given substance to be measured, and g the value 32.16, the acceleration

of gravity, the velocity of the steam or other liquid can be determined. From the velocity so obtained and the density of the substance, as well as the pipe cross-sectional area, the quantity flowing per hour can be determined.

In a practical measurement, it is, of course, necessary that readings be taken continuously, and the time, pressure and manometer reading noted whenever a change in deflection or pressure occurs. It

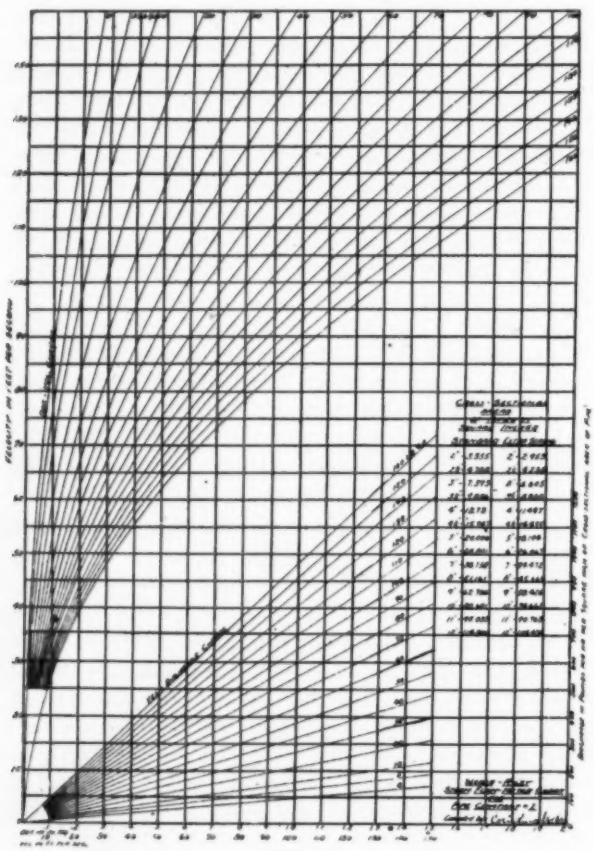

Fig. 2

is also necessary to make a traverse across the diameter of the pipe, to determine the ratio between the average velocity and center velocity to arrive at the pipe constant.

The instrument has been carefully calibrated by condensing and weighing the steam that was measured, and it was found that it has a well defined constant of about .84, that is, the formula V=.84 2 gh applies to the instrument itself.

Evaporation tests made on boilers, steam consumption tests on engines, and heat balances have been made with this instrument with most gratifying results.

The tedious process of calculations has been minimized through the curves developed and shown in Fig. 2. These curves have been worked out for a pipe constant of one, and other curves for other pipe constants have been derived.

From a given deflection and pressure reading, the velocity is found at the left, when deflection is noted at the bottom. Transposing the velocity so found at the left to the other scale at the bottom, the flow in pounds per hour per square inch of cross-sectional area is read at the right. Consulting the table of pipe sizes, the actual flow is readily determined.

As an example, let it be supposed that in a standard 5″ pipe under 100 lb. pressure, a deflection of .3″ of mercury is to be interpreted, the value .3 is sought at the bottom, and the vertical line followed until the 100 lb. deflection velocity curve is intersected. Reading to the left of this intersection, the value 52.5 feet per second is found. Taking the value 52.5 at the bottom and following the vertical line until it intersects the 100 lb. velocity discharge curve, it will be found by reading to the right of the point of intersection, that 335 pounds of steam are flowing per hour per square inch of pipe area. Multiplying 335 by 20, the pipe area, it will be found that there are flowing 6,700 pounds of steam per hour.

The instrument can be used on any size of pipe and will measure air, gas, oil or water with the same facility with which it measures steam. The density of the manometer liquid and the liquid to be measured must, of course, always be taken into consideration.

Superheated steam at 150 lb. ga. with 150 degrees of superheat have been measured with this instrument and with entire satisfaction, and the writer feels that the disadvantage of the necessity to take readings at short intervals is offset by the many other advantages that it possesses, for it can readily be carried from place to place and installed quickly. The absence of moving parts and mechanism and general simplicity make it accurate and reliable.

Loss Due to Soot Formation

Boiler tubes should be blown externally once every eight hours when boilers are in continuous service. Many satisfactory makes of soot blowers are on the market for this purpose.

With certain kinds of coals, the lower rows of tubes are liable to be coated with a clinker formation due to fusing of fine ash which is carried with the gases at relatively high gas velocities. This formation must, in most instances, be removed by scraping of the tubes; blowing with steam at frequent intervals will reduce the time interval between scraping periods. It is important that this point receives attention, as otherwise the formation mentioned will obstruct the gas passage-way through the tubes. The furnace draft will be impaired and prevent relatively high boiler ratings from being maintained.

The best safety device known is a careful man, says the National Safety Council.

Distribution of Overhead Expense

By PROF. F. H. ELWELL
University of Wisconsin

Presented at the Annual Meeting of the Cost Association of the Paper Industry, on May 17, 1920, at the Hotel Cleveland, Cleveland, Ohio

IN a group of cost accountants it is almost unnecessary to speak of the necessity for giving close study and thought to the matter of overhead expense distribution. We all know that it is the one place where we may go far astray from the sound, logical path by not applying the method or methods which best fit the conditions prevailing in the various departmens. Too often the easy, simple methods are the ones followed and the results are sometimes grossly inaccurate. The executives who rely upon such information might easily adopt certain policies actually contrary to the best interests of the concern, and when they discovered that results were contrary to their expectations, the cost system itself would be blamed.

Whose fault is it? I believe it is the fault of those responsible for the installation of the system and also of those who make the actual installation. In this particular industry, there are probably very few men left who do not appreciate the necessity for thoroughly studying situations and problems and adopting the methods best suited to your industry rather than taking the easiest way only because it is the simplest.

In behalf of the other group who undoubtedly are to blame for much of the trouble caused by the installation of impracticable cost systems, let it be said that the general business world has become convinced that cost accounting really accounts for costs, and that those so-called accountants who attempt to force their "easily-sold, easily-kept, inaccurate results" systems upon the public are rapidly disappearing. Such associations as this have done much to convince executives of the value of accurate methods of distributing overhead.

I am just completing a survey of the National trade associations which have adopted so-called uniform cost systems for their members to use. In several cases, the secretaries of these organizations have informed me that their system at the present time consisted solely of advocating the way in which the overhead expense items should be distributed. It would seem fair to assume, therefore, that from a competitive standpoint manufacturers are appreciating what it means to employ the same general basic methods for distributing these overhead expenses. Unquestionably, it is in the center of the problem of cost accounting, and every point related to it must be collected, analyzed, proved, and interpreted before we can feel even present-day satisfaction with the methods we are using.

It might be interesting to you to know that in this survey of some two hundred associations, the point most generally stressed was that of nomenclature—a terminology common to the industry so that members all over the country will be using accounts which have the same meaning in the different plants.

In this connection, I should like to express the thought that this group of cost accountants working together in the common cause, as you are, will undoubtedly advance the subject of cost accounting far more than the normal progress ordinarily obtained in those lines where the old competitive spirit yet survives. This spirit of coöperation is what is going to help the industry, and no man can attend your conventions without appreciating that you are among the leaders in this cause for seeking the truth regarding costs.

First of all, what is meant by the term Indirect Expenses? Here the important thing to note is the fact that our financial accounts are kept generally by the store room or horizontal basis, and that the moment costs are discussed the departmental or vertical basis is employed.

Thus in explaining the term "indirect expenses" the vertical classification will be used to include those expenses which cannot be distributed directly to the product passing through the mill. The three groups common to the paper industry are:

Mill Indirect Expense.
Selling Indirect Expenses.
Administration Indirect Expenses.

It is probably quite necessary to give a detailed itemized list of the typical expenses occurring under each of these headings which cannot be distributed directly to the product, yet to make the paper complete they are included.

Mill Indirect Expense—
- Material Departments Expense.
- Purchasing Department Expense.
- Receiving Department Expense.
- Store Room Expense.

Indirect Materials (Subdivide as necessary, perhaps into) Supplies—
- Small Tools.
- Miscellaneous Materials.

Fixed Charges—
- Property Taxes.
- Insurance.
- Depreciation.
- Repairs.
- Power.
- Repair Department Expense.

Fixed Charges—(Continued)
- Heat and Light.
- Idle Productive Labor.
- Mill Obsolescence.
- Grounds Expense and Upkeep.
- General Laboratory.
- Mill Supplies.
- Packing and Shipping Department Expense. Cost of cases, crates, wrappings, packing, handling and storage.

Selling Expenses—
- Salesmen's Salaries.
- Salesmen's Commissions.
- Salesmen's Traveling Expenses.
- Sales Offices (Main and Branch) Expenses. (Subdivide as necessary for adequate control into perhaps)
  - Salaries.
  - Rent.
  - Telephone and Telegraph.
  - Postage, etc.
- Advertising.
- Freight and Cartage Out.
- Credit Department Expenses.
- Finished Goods Warehouse Expense.
- Sundry Sales Expenses.

Administration Expenses—
- Officers' Salaries.
- Office Salaries.
- Rent.
- Light and Heat.
- Telephone and Telegraph.
- Stationery and Printing.
- Postage.
- Office Supplies.
- Trade Association Dues.
- Trade Paper Subscriptions.
- Sundry Office Expenses.

The next step in the study of the distribution of overhead expense results from a realization that it would be quite inaccurate to assume that every product passing through your mill should be charged with exactly the same amount of overhead expense. The facts need only be mentioned that these indirect expense items are not borne by all departments of the business alike, and that some product may go through all departments and some through only a few. In either case, inaccurate product costs would result if such differences were not taken into account.

It is not sufficient to think that the deficit in one department will be offset by the surplus in another. If we remember that costs are to be used as a guide in determining profitable selling prices, it may be seen very readily how this inaccurate system of departmental expense distribution may lead to disastrous results.

The Division of Indirect Expenses Over Departments

For these reasons, the mill is divided into departments, factors or centers depending upon the conditions prevailing within each plant. It should be realized that as far as possible all indirect expenses should be applied direct to the departments incurring them. Very frequently, such expenses amount to far more than at first supposed, and the fewer the items and the smaller the amounts to allot to departments, just so much more accurate are the departmental costs. The unit bases for apportioning the mill expenses fairly between the departments are then decided upon. It should at once be apparent that this division of the general mill indirect expenses over the operating departments is one of the most important phases in cost accounting. Among the unit bases used for distributing some of the general items are the following:

Items—	Unit Basis—
Mill Fixed Charges.	Square feet or cubic feet.
Taxes.	(This unit cost allows comparative space costs to be made between different periods and shows the cost of having surplus space.)
Insurance.	
Depreciation.	
Repairs.	
Heating.	Same as mill charges or square feet of radiation.
Light.	Number of Lights; on the basis of space; or K. W. H. The last one is preferable.
Power.	H. P. H. or K. W. H.

Administration Expenses:

Another group of indirect expense items which must be considered at this time is administration. Administration is divisible into two groups—general office and mill. The latter group may be subdivided into general mill administration and into departmental mill administration.

General mill administration expense includes the salaries of the mill superintendent and assistants, the expenses of the cost and payroll departments, the fixed charges on mill office furniture and furnishings and sundry mill office supplies and expenses.

Departmental mill administration expense includes the salaries of the foreman and departmental clerks, the fixed charges on departmental office furniture and furnishings and sundry departmental office supplies and expenses.

It should be noted that these two subdivisions of mill administration expense include the items usually grouped under the subheading "indirect labor."

The general mill administration expense may be distributed over the departments either on the basis of the normal number of departmental employes or on the basis of the productive wages paid. Are the

general office administration expenses to be apportioned between the mill departments, applied entirely to conversion cost, or divided in some proportion between the sales department and the mill?

Each of these methods seems to have been used by paper mill cost accountants in disposing of this group of items. Can we not agree upon the method to recommend, and thus secure one more step toward uniformity of method which will allow ready comparison of hourly rates without so much of the constant qualification necessary at the present time?

The Budget of Indirect Expenses

Now, that the items to be included as mill indirect expense and the unit bases of their distribution have been decided upon, the next step is to decide upon the **amounts** to be used. Certain it is that a cost accountant cannot wait until actual costs of the period are available before he gives the executives the "cost" price of the product. (This is actually done, however, and may be accepted as one of the elementary stages of interest in cost accounting.)

Sales are usually in advance—not from stock where the sales price was determined solely on the basis of actual costs. The importance of this point was well expressed by the president of one of your leading companies in Cost Association Bulletin Number Seven.

In other words, the cost accountant and the executive must build up the budget of mill indirect expenses and allocate the amounts over the departments on the unit basis above mentioned. The subject of expense budgets might well be the subject of an individual paper. The subject warrants far more attention than is generally given to it.

The facts are that many large companies have expense budgets for their production, marketing and administrative divisions. Such budgets are usually expressed in terms of percentage on gross sales. The budget for each division should be planned with the greatest care, and after the several divisional budgets are brought together, they should be compared to iron out any inconsistencies which may be obvious when comparison is made with other divisions, but which appeared proportionate when considered within a single divisional budget.

Stress is laid upon this matter of budgets, for it seems to me that far too little attention has been given the possibility of executive control through budgetary procedure. Again, it seems logical to me that the cost accountant should be the one man conversant with such affairs throughout the entire establishment.

Please notice that I did not use the word "mill" as a prefix to cost accountant—I refer to the cost accountant of the entire plant. If this official is to be responsible for obtaining the cost of the product he should have a voice in the manner in which data for his use is to be prepared. Unquestionably, this brings up points in organization relative to the sales manager, the office manager and the factory accountant, but I am considering the cost accountant as the one in charge of **all** cost work.

The comparison of budget estimates with actual expenses and with the amounts absorbed by the product will be referred to later, but it is mentioned here so that one of the chief values of expense budgets may not be forgotten.

Budgets are first compiled for the mill as a whole —upon the store room classification basis—and then separate departmental budgets—upon the vertical classification basis—are compiled upon the unit distribution of items already discussed.

In connection with departmental budgets, it should be noted that while the estimate is probably made for the year, the period which the cost accountant usually takes as a working basis is either the calendar month or a four-week period. This short period allows the comparison of actual and estimated expenses and permits of the changing of policies to meet the new conditions which may arise.

The Value of Accounts with Budgeted Items

Many forms and distribution blanks have been designed for recording the distribution of these indirect expense items over departments. Attention is called to the fact that these reports, forms and blanks need to be carefully worked out to fit the needs of the individual establishment.

It has always seemed to me that it would be safer to keep accounts with the several general items of indirect expense and be certain that the amounts are cleared into the proper departmental or other accounts. This does not mean that reports of overhead distribution would not be prepared, but it does mean that as cost accountants we would be far more certain of knowing that all expenses had been properly allocated and distributed. Take the matter of mill fixed charges, for example.

If the proper proportion of the accounts with property taxes, insurance, depreciation and repairs, are closed into an account called Mill Fixed Charges, the distributions may be cleared into the departmental accounts and the distribution of the total will be apparent at a glance. All too frequently it is found that some items have been overlooked, and with the cost accountant's familiarity with accounts, it would seem that they would naturally use them in this connection far more than they do.

It is, of course, recognized that the exact method of building up accounts with the budgeted items and the several divisions thereof, depends entirely upon the type of cost accounting system in vogue. It may easily be imagined that such accounts would be merely supplementary to the general and cost accounts and would not appear in either the general or cost ledgers.

Let us now assume that departmental budgets have been prepared and that we are certain that all items have been included. We are to consider methods of distributing these mill overhead expenses to the product passing through the departments.

There are several methods of distributing mill burden in vogue at the present time in different mills. To name the ones generally found to a group of cost accountants is probably sufficient to recall the advantages and disadvantages of each method without going into a detailed discussion of them. The most commonly found are the following:

Productive Wages.
Productive Hours.
Material and Labor (Prime Cost).
Machine or Departmental Rates.
The Sold or Chargeable Hour Plan.

Of the many points to be borne in mind in connection with the above rates, time permits calling attention to but one of the most important—the hours to use as the denominator under the machine or departmental hourly rate method. You will remember that when the first machine rates were established, the total mill overhead was divided by the hours which the machine was supposed to run—if a nine-hour day, 300 days to the year, then 2,700 hours should be the denominator.

The weakness of this method was soon apparent, for what was to be done with the undistributed machine or departmental expenses? Some advocated they should be distributed over the product which had gone through the mill on the basis of productive wages or productive hours. In either case, it is apparent that the costs are not the costs of the particular products of the period but an attempt to load all the costs of the period on all the orders.

In this connection, attention should be called to the excellent illustration of this point given in Cost Association Bulletin Number Six. (Mr. John Balch, Cost Accountant of the Chemical Paper Manufacturing Company, Holyoke, Mass.) It was given as follows:

Possible Hours Per Year—52 weeks at 144 hours per week		7,488
Deductions—	Hours	
Changing wires and Felts	111	
Starting and Stopping	162	
Repairs	104	
Holidays	144	
Annual Shutdown (3 days)	72	
High Water in Connecticut River, preventing use of water wheels (contingent)	96	
		689
Net Normal Productive Paper Machine Hours per year		6,799
Net Normal Productive Paper Machine Hours per period (4 weeks)		523

Think what it would mean, if instead of recognizing these deductions, this cost accountant had taken the total possible hours as his divisor in obtaining hourly machine rates. Certain it is that the **proper** costs must be absorbed by the product, and furthermore, it is believed that such typical, recurring average items as enumerated above as deductions are properly made in order that the **normal operating** number of hours may be obtained.

Considerable time might be spent upon developing this matter of normal costs and of deciding upon the point beyond which the cost of idleness is chargeable against Profit and Loss (**net** income) rather than against production.

Estimated, Actual and Absorbed Indirect Expense Items

Thus far the discussion has related to the nature of indirect expense items, and to methods of determining and distributing the **estimated** expense items over the departments. The work of treating indirect expense is approximately one-third done when this point has been reached. Two very important phases of the work remain—to compare the estimates with the actual expenses and with the amounts absorbed by the product passing through the mill. This is a triple check which is highly important and should never be overlooked. It is the more interesting from an accounting standpoint, since an account has but two sides, and with three types of information to record, the necessity arises for using more than one account. Let me repeat that it is well realized that such information may be obtained in other than account form.

The two accounts which may be used for this purpose may be called departmental indirect expense and departmental burden. One way of obtaining the triple check above referred to is to debit departmental indirect expense with the estimated indirect expenses, and to credit this same amount to departmental burden. The actual departmental indirect expenses incurred may be debited to the departmental burden account, and the absorbed amounts may be credited to the departmental indirect expense account. The balance of the departmental burden account will indicate the over or under estimate and the balance of the departmental indirect expense account will represent the unabsorbed burden.

Attention is called to the fact that in these unusual times, it is absolutely necessary that a close check be kept upon actual expenses and the estimates of such expenses. Where a month is used as a working period, such a check is both possible and practicable, and permits the management to make necessary adjustments in administration or in rates to meet the new conditions.

In order to take care of the discrepancy between estimated and absorbed burden, a reserve for overhead account may be used. As already implied, the

balance of this account at the end of a fiscal period would be closed into production or into profit and loss (against net income).

Furthermore, frequent checks should be made to be certain that all departmental rates are being charged properly to the product, and that the difference between the debit "estimates" and the credit "absorbed" of the departmental indirect expense account is actually due to the mill not operating on normal capacity, rather than finding that errors have been made in charging out the departmental and machine burden. All too frequently such checks are not made and errors are allowed to continue which might easily be discovered, and then naturally corrected, by giving a few hours' attention to the matter per month.

Distribution of Selling Expenses

The method in vogue of distributing sales expense evidences the fact that the subject of cost accounting is just beginning to be studied. To take the sales expenses for the past year as a basis and to divide their total by the sales of the period gives a percentage which many apply to the current period. Obviously such a method used in a period of increasing prices means that sales expenses are not likely to be covered and that the company would lose money through the adoption of such a plan. Instead of this unsatisfactory method, the sales expense budget should be prepared with a realization of present conditions and with as much care as the mill expense budget, and the total thereof should be compared with the total estimated sales in order that an up-to-date selling expense percentage may be obtained.

The items of selling expense were given earlier in this paper. In the preparation of the selling expense budget, there should be included with these items that portion of the general administration expenses which it is believed the sales department should bear.

The sales expense budget and the sales quota budget should be compared with actual results in order that due recognition may be given the matters which need adjustment.

The plan above outlined, followed quite generally at the present time, assumes that it cost exactly the same to sell a dollar's worth of paper, regardless of grade or quantity. Upon analysis, such a method does not seem fair, and I predict that within the very near future steps will be taken in this industry for the allocation of selling expenses over output in much the same way as we now distribute mill indirect expenses over the operating departments. Of course the factors to be used as the basis for such a distribution are far different from those used as a basis for the distribution of mill expenses. They can be determined, however, and the results applied to the products of your mills so that the sales expenses will be distributed according to sales services rendered rather than a uniform blanket rate for all products.

In conclusion, I should like to leave with you the thought that, as cost accountants in one of the nation's most important industries, you have a wonderful opportunity for real constructive work. There is great demand for the services of men who have the capacity to install, operate and perfect cost accounting systems.

The executives of the paper industry are realizing now, more than ever before, the necessity for cost accounting, and the services you are capable of rendering them will be the foundations for the determination of many of their business policies.

Be certain, therefore, that you are giving your professional work the results of your best judgment and thus be able to face the many new problems which constantly appear in your work with that spirit of enthusiasm, confidence and satisfaction over work well done, which means much toward attaining success.

The spirit of the Cost Association of the Paper Industry—the spirit of coöperation and helpfulness—will be a most valuable aid in accomplishing that attainment.

Making Wood Fire-Resistant with Paint

Fire retardent paints are the most practical means so far discovered by the Forest Products Laboratory by which small amounts of wood can economically be made fire resistant. The only other known methods of decreasing the inflammability of wood are to keep it wet, or to inject into it certain chemicals under pressure. These methods, though more effective than painting, are usually either impracticable or too expensive to be considered.

Ordinary calcimine or whitewash has proved in tests to be as fire resistant as any paint covering tried. It is cheap and convenient to use. Although it will not prevent the burning of wood exposed continuously to a high heat, a good coat of calcimine on wood will decrease the danger of a blaze spreading from burning cigarettes, sparks, matches, and similar small sources of fire. Calcimine is, of course, more effective for inside than for outside use.

For exterior use, numerous patented fire retardent paints are available. An effective outdoor paint which has been developed at the Forest Products Laboratory consists of linseed oil, zinc borate, and chrome green. This paint has maintained its fire resisting properties through more than three years of exposure to the weather.

The Crandon Mfg. Co., Portland, Maine, advise that their acid control system for controlling the operation of sulphurous acid making plants is now being used in about thirty mills.

Advantages of Autogenous Welding and Cutting Equipment in the Paper Industry

By J. H. OSBORNE

IN the paper industry, as in any other large industry, it is quite essential that the machinery which is running night and day, in order to put out the required amount of material to be used on the market, should be taken care of in the best possible manner and should be kept in running order at all times and not be allowed to run down, so that shutdowns will be necessary and a loss of production result.

One of the most essential of equipments to be had for the prevention of such delays, due to breakage of parts and undue wear on certain pieces of the equipment, is the oxy-acetylene welding equipment.

With the use of an oxy-acetylene outfit, it is possible to repair all parts of machines of any description which are broken or worn, and thus prevent undue delay caused by waiting on the manufacturer of the machine or part to send it to the point where it is to be used. Often times a gear will be stripped on one of the machines in the mill, and, if the machine has been bought from a manufacturer whose plant is at some distant point, it will be necessary for the mill to be shut down for possibly a week or ten days, and some times even longer than that, before it would be possible for them to resume operations, simply because they would have to wait for the manufacturer of that certain gear to send them another one like it, so that they could replace it in the position where the broken one was. If that mill had in its repair equipment an oxy-acetylene welding outfit, it would only be necessary for the gear to be taken from the machine, and the teeth which were broken or the parts which were broken off welded on again or built up, and then machined, and, in a very short time, it would be possible for them to replace the gear repaired and resume operations as usual.

With the oxy-acetylene welding blow-pipe, it is possible to weld any metal, and, therefore, it is not limited in any way by the kind of material on which you are working. It would be quite possible in many instances to save time and money in repairing pipe lines and such parts which would become leaky. It is only necessary to drain the water from the pipe line and weld up the hole which has sprung in it and let it cool off, and then run the water back into it, and you have a repair which is as good as it would be if you took out the whole length of pipe and replaced it with another and possibly spent much more time than it would be necessary to spend welding it in doing so.

The oxy-acetylene welding blow-pipe is also a very convenient tool to use in connection with the building up of tanks or traps which are much used in the paper industry. It is not necessary to use the old riveting methods any longer because of the fact that with the use of the oxy-acetylene blow-pipe it is possible to weld the sheets together and form a solid union which is water-tight and does not have to be calked or packed in any way, and will remain welded indefinitely and give much better service than the old time riveted seam.

With the aid of the oxy-acetylene cutting torch, it is quite possible at some time to form special benches, jigs and templets to be used in connection with the machines which you already have, and, a great many times, time and money may be saved by using the torch instead of using the old machine method of roughing out the pieces. The oxy-acetylene blow-pipe is clearly a money and time saving appartus, should be placed in every industrial organization of any kind where machines are used and break-downs are bound to occur. It is an apparatus which will pay for itself in a very short time and one which can be used in a thousand and one places, which will be found as time goes on.

The oxy-acetylene process of welding and cutting is no more an experiment, is a practical equipment made for practical purposes, and should be one which the paper industry especially would welcome to inaugurate into its repair equipment, because of the fact that the machines used for making paper and pulp are in use continually twenty-four hours during the day and naturally will show wear and tear and break down oftener than in other industries.

The conditions in boiler plants show that operators must be trained in the combustion of fuel. Specialization is as much needed for the highest efficiency in coal burning as in any other work. Building up the standard of intelligence in the boiler room involves no disparagement of this kind of work. Opportunities should be offered for an intelligent understanding of the principles involved in order to acquire and maintain a high standard of fuel burning.

If exhaust steam is wasted, coal is being wasted. Use all exhaust steam wherever possible. If very much is being wasted, there may be something wrong and it would be advisable to obtain engineering assistance.

Advantages of Superheated Steam

By ALBERT W. STEPHENSON

Since no two power plants present the same conditions, the subject of this article can only be treated in a general way. The possible economies resulting from the installation of a superheater depend on how far a plant is already economically developed, and can only be determined by having the superheater manufacturer study the conditions in the plant carefully and then render an unbiased and accurate opinion as to its merits.—Editor.

THE value of fuel used annually in this country alone is estimated at over two billion dollars. Because fuel used for power plant or power station service represents the largest single item in the cost of producing power, its utility must be increased. Each pound of coal burned, each gallon of oil consumed under a boiler for the generation of steam not only must be accounted for, but also must be made to do more useful work.

Of all the means known or practiced to improve the efficiency of a plant, the application of high degrees of superheat, for the investment, shows the most profitable and practical returns. Because superheat offers economies greater than any other single improvement in power plant design, it commends itself to even closer consideration than engineers have hitherto given it.

The returns from superheating are evidenced by a considerable reduction in the cost of operating a steam plant. Within practical limits of temperature, it has been found that the higher the superheat, the greater the economy.

The increased economy is effected in general in four ways, viz.: by increasing boiler efficiency, by reducing condensation losses in steam lines, by reducing the steam consumption of the prime mover, and by increasing the capacity of the plant.

Superheating Increases the Boiler Efficiency

A definite amount of heat is required to superheat steam to a certain temperature and this heat is furnished by the fuel. When a definite weight of steam is generated, additional fuel will be consumed to superheat this steam.

Let us assume a boiler designed without a superheater to give the highest practical thermal efficiency. Suppose we install a properly designed superheater in this boiler. It will be found that the overall thermal efficiency of the combined boiler and superheater will be greater than the boiler without the superheater when evaporating the same amount of water, because by the addition of the superheating surface more heat is absorbed and the final uptake gas temperature is lowered. This result can be accomplished, however, only when the superheater is correctly designed so as not to obstruct unduly the flow of the gases through the boiler. Undue obstruction to the gases would decrease the overload capacity of the boiler. A properly designed superheater will not alter furnace conditions in any way. Considering a given furnace condition and a given rate of firing, these facts are indications of added efficiency.

Eliminating Steam Line Condensation

Many power plant installations are forced by local conditions to operate their prime movers at long distances from the boilers supplying the steam. The long pipe lines carrying the steam often are run out of doors where they are exposed to all kinds of weather. These conditions naturally have a marked effect on the quality of steam when it reaches the point where it is to be used.

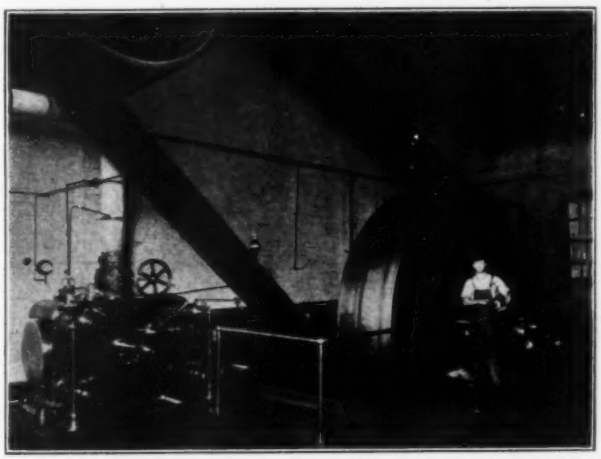

Fig. 1—Corliss Engine Operating on Superheated Steam.

Superheated steam prevents condensation in steam lines and delivers dry or superheated steam within practical limits to the steam user. This advantage is due to the fact that no moisture or water is carried over from the superheater and also because the low thermal conductivity of the superheated steam prevents condensation. Superheating is advantageous not only from a economical standpoint, but also because it eliminates water hammer and its attendant engine and pipe troubles.

It is a matter of historical interest that the first recorded use of superheated steam was necessitated

by the condensation which took place in a long steam line.

Long pipe lines now carrying saturated steam can be used for superheated steam without any change, resulting in a great saving in the available heat and quantity of steam delivered for power purposes.

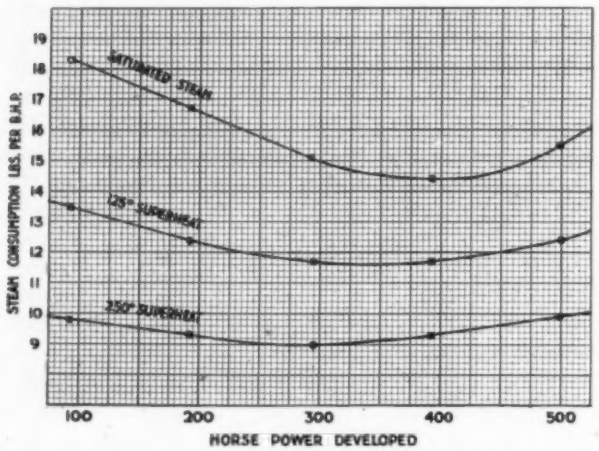

Fig. 2.—Steam Consumption of a 250-H.P. Compound Condensing Engine at Different Loads.

This fact alone should make the use of superheated steam on long pipe lines universal practice.

When condensation in steam lines is reduced, both steam and coal are saved, because in the generation of steam, about nine-tenth of the heat absorbed by the water in evaporating it and raising the steam pressure is latent heat. When steam is condensed, latent heat is liberated and unless it performs useful work it is wasted. Condensation, therefore, occurring in pipe lines, represents an absolute waste of nine-tenths of the heat, and if the condensate is not returned to the boiler all the heat is wasted. A superheater is absolutely essential to raise the temperature of the steam to a point that all of it may be transmitted to its destination and used without condensation losses.

Importance of Superheat in Steam Turbines

High degree superheat is of vital importance in steam turbines, and the steam turbine is particularly adapted to its use. All turbine plants of any size are now using superheat, several modern plants operating at superheat temperature up to 250°. Turbine manufacturers have made a strong claim in favor of turbines, in that high degrees of superheat can be used. The most economical steam prime movers of today utilize steam with as high as 300° superheat. These turbines produce a K.W.H. for 11.5 lbs. of steam or a brake horse power hour for eight pounds of steam.

The water rate of an economical steam turbine will be reduced 1% for every twelve degrees of superheat up to 200°. This figure is based on large and economical turbines. Small turbines, inherently less economical, show a greater proportionate saving with superheated steam.

The above results are based upon the assumption that perfectly dry steam has been delivered to the superheater. This condition, however, seldom exists. The usual type of horizontal return tubular boiler with a comparatively large water and steam capacity delivers wet steam. The modern water tube boiler with less water and steam space is much worse. This condition is accentuated, particularly by the fact that the modern water tube boiler is forced to evaporate water at a rate 3 or 4 times that of the return tubular boiler, and the percentage of moisture in the steam from such a boiler is high. Take for example a 500 h.p. water tube boiler having a 42″ diameter steam drum. At normal rating such a boiler will deliver 15,000 lbs. of steam per hour. Conditions often arise when such a boiler will be called upon to evaporate 30,000 to 40,000 lbs. of water per hour. Superheat takes out all the moisture that otherwise would be carried over and is, therefore, particularly beneficial when boilers operate at high capacities.

It is this moisture which is particularly damaging to steam turbines. It reduces the efficiency by the excessive friction between the water and turbine parts. One authority points out that a turbine without superheat is merely a form of Water Brake,

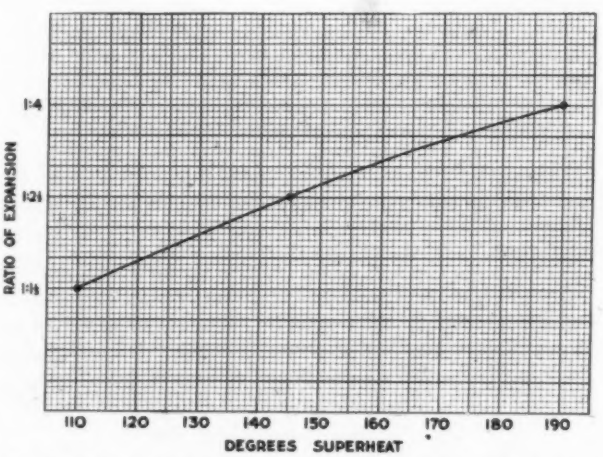

Fig. 3.—Superheat Required to Prevent Condensation for Various Ratios of Expansion in Reciprocating Engines.

for every ounce of water passing through, no matter how finely divided, is inert material, and serves only to check the running of the machine.

The internal surfaces of the turbines are enormously increased beyond those in reciprocating engines, and the effect of temperature range in augmenting condensation is very great, even though the temperature in the turbine does not change so widely.

The destructive effect of water and moisture on the turbine blading is too well known to be more

than mentioned. The erosion of turbine blades due to water is very rapid. The effect of this erosion is immediately felt in increased steam consumption. When highly superheated steam is used, however, water is not present to cause this erosion. Blade wear is greatly reduced through superheating and reblading is necessary only after much longer periods of operation than when saturated steam is used.

Superheating Increases the Efficiency of Reciprocating Engines

Generally speaking, the reciprocating engine will be benefitted more by superheat than the steam turbine will. The saving to be expected by superheating is dependent on the amount of cylinder condensation that would occur in the same engine if no superheat were used. Evidently, the greater this condensation, the larger is the saving possible.

When steam is superheated 200° or even 250° F., it can be exposed to the cooling action of the steam chest and cylinder walls without condensation, and has 30 to 40% greater specific volume than saturated steam of the same pressure. For example, 1 lb. of water at 170 lb. pressure absolute produces 2.68 cu. ft. of saturated steam at 368° F. temperature. After passing through the superheater and gaining 200° superheat, the volume will have been increased to 3.54 cu. ft. A part of this increased specific volume is lost before the expansion of the steam in the cylinder takes place on account of the cooling action of the cylinder head, piston and cylinder walls. While the superheat in the steam entering the cylinder may be 200° to 250°, the superheat of the steam in the cylinder at the moment of cut-off is considerably less. The elimination of all condensation losses together with the increased volume of the steam, effects substantial savings in the steam consumption and in the fuel consumption when compared with saturated steam operation under the same conditions.

The opinion frequently has been advanced that the mean effective pressure in cylinders using superheated steam is altered from that existing when saturated steam is used, the initial pressure, the point of cut-off and piston speed, of course, being assumed as the same in each case. Theoretical considerations would indicate that a lower mean effective pressure with superheated steam is obtained, and this conclusion would be based upon the knowledge that the expansion curve of superheated steam is steeper, that is to say falls more rapidly than with saturated steam. In practice, however, with highly superheated steam a mean effective pressure at least equal to that with saturated steam is obtained. An explanation will make this point clear. For example:—in simple non-condensing engines the back pressure line of an indicator card is decidedly lower with superheated steam than with saturated steam, a condition to be expected because the steam exhausted contains less moisture. It is, therefore, lighter than saturated steam, and flows through the exhaust passages with less resistance. Mr. C. D. Young, before the American Society of Mechanical

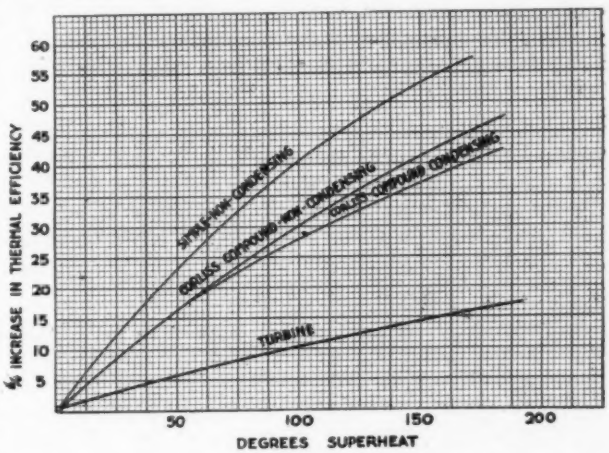

Fig. 4.—Effect on Thermal Efficiency by Various Degrees of Superheat.

Engineers, in December, 1912, gave conclusive evidence of this fact.

In the case of multi-expansion reciprocating engines the cards taken from the low pressure, and, in the case of triple engines, from the intermediate pressure cylinder, show that a higher m. e. p. is obtained with superheated steam. In the high pressure cylinder of multi-expansion engines it is generally true that the cut-off should be increased if the power output of the engine is to be maintained.

But our consideration of the possibility of increased engine power, due to superheating, must not stop here. Consider a saturated steam plant in which the boilers are operating at their full capacity to supply the steam demanded by the prime movers. Take this same plant and superheat it—the decrease in steam consumption per horsepower hour will result in a reserve boiler capacity which will make possible either the operation of the boilers at lower rating or will furnish the additional steam necessary to meet an overload on the prime mover. In other words, superheating makes it possible to increase the power which the prime mover may develop over what it could produce with saturated steam.

In new installations, the use of superheated steam permits the use of engines having larger cylinder diameters and enables them to be operated with shorter cut-offs. Because cylinder condensation is eliminated, the gain in economy due to a more effective expansion of the steam is realized.

Experiments have shown that the degree of superheat necessary to prevent cylinder condensation varies as a general rule with the ratio of expansion.

In American practice the steam temperatures ordinarily recommended are: up to 500° F. for Corliss and slide valves; up to 650° F. to 700° F. for piston and poppet valves.

The gain from decreased steam consumption due to superheated steam is ordinarily expressed in per cent. This gain will vary in various types of engines with the different superheat temperatures used. For example, with 150° superheat, the following gains are produced: in simple engines 22-24%; compound engines 16-19%; triple expansion engines 14-16%; uniflow engines 10-12%. It is, however, an assured fact, and a strong argument for the more general adoption of high degree superheat, that only engines designed for high degrees of superheat and using it can successfully compete in economy in the power generation field.

Advantages When Operating at Reduced Pressures

It is often necessary, particularly with old boilers, to reduce the operating pressure. This condition

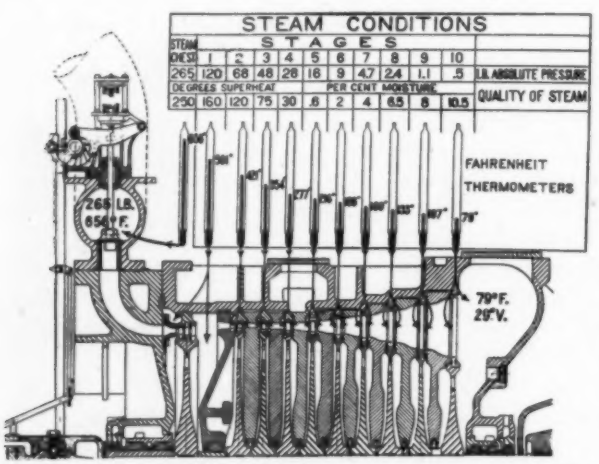

Fig. 5—Section of Ten-Stage Turbine, Showing Condition of Steam in Each Stage.

results in a loss in plant capacity. Superheating such boilers will enable them to meet the power demands of the plant at the reduced pressure just as well as the boilers did before the pressure was reduced. Furthermore, superheating in the majority of cases will provide an additional reserve power over that of the plant before the pressure was reduced.

Power Plant Cost with Superheat

The installation of superheaters materially lowers the plant cost. Where it is used, a smaller amount of boiler horsepower is needed to deliver the same power. Roughly speaking, six boilers equipped with superheaters, furnishing 150° of superheat, will carry the same power load as seven boilers delivering saturated steam. By reason of this fact alone, smaller feed pumps, smaller stacks, smaller coal handling apparatus and less coal storage space are sufficient for the demands.

Piping can be reduced in size, because higher steam velocities with superheated steam are possible. This reduction in pipe size will effect a saving not only in the pipe line but also in valves, fittings and covering.

In the turbine room, superheated steam will allow the use of a condenser of smaller size than if saturated steam were used. Consequently, smaller circulating water pumps, hot well and vacuum pumps can be used and minor apparatus such as steam separators often can be dispensed with.

These items materially reduce the initial plant cost.

Conclusion

When superheating is correctly applied to the individual conditions in a specific plant, it is the one means which will positively show an improvement in power plant operation in at least one and probably all parts of the plant where steam is used.

All the more astonishing, therefore, becomes the fact that in spite of all these practical advantages, only about 15% of the steam horsepower of this country is developed from superheated steam. Furthermore, this percentage represents not more than perhaps 5% of all the steam power plants, indicating that only plants of large capacity, inherently more economical than the vast majority of stationary plants, use superheat.

Is it logical that comparatively few plants having high evaporation rates and low steam consumption, should be the ones to benefit by superheat, while 85% of the nation's steam power uses fuel extravagantly? This condition is not consistent. The opportunity and the means to conserve fuel are available and the necessity is urgent.

Installation of Stokers

The days of hand-firing are numbered. The great variety of mechanical stokers put on the market in the last few years provides a stoker adaptable to almost any coal and any size or number of boilers. There is every physical and labor reason why the commercially unavoidable waste of coal by hand-firing should cease. Firemen, therefore, should visit stoker-fired plants and study the construction and operation of the many types of stokers. Ask your employers to send for the various stoker catalogues and give them to you.

The size of coal has a considerable bearing on the relative capacities and efficiencies obtainable from a boiler. The air pressure penetrates the fuel bed formed by the coarse coal easier than the fuel bed formed by the finer coal, resulting in disturbance of the best furnace conditions.

The Future of Acid Making

By O. L. BERGER

Presented at the Convention of the American Pulp and Paper Mill Superintendents' Association, at Buffalo, New York, June 4-5, 1920.

WHEN your chairman selected me to talk to you on this subject, he overlooked one important fact; namely, that I am not a prophet. He should have picked out someone able to read the stars and give you a true picture of the FUTURE. I once had a teacher who said that the most important reason for studying history was that from past performance we would be able to anticipate future events. It seems therefore proper that we should look back and see what steps have been taken in bringing this branch of our industry up to its present position and thus, maybe, be able to gaze into the future.

The fact that cellulose could be separated from wood by the dissolving properties of Calcium-bisulphite solution on lignin was discovered and patented by an American, B. C. Thilgman, way back in 1866, but he never lived to perfect his process. This was done by the Swede Ekman and the German Mitscherlich, who independently manufactured sulphite pulp on a commercial scale in the years 1872 and '74 respectively. Both these gentlemen used the limestone method for making of acid; Ekman using short towers and Mitscherlich using the high wooden towers still in use in a number of mills both here and abroad; both using counter current principle. A little later, we find that the "Milk of Lime" systems started to be installed especially in U. S. A. One of the first ones of this kind was McDougall which works on the pressure principle. A compressor forced the combustion air through a closed retort containing the sulphur and the resulting SO_2 gas into closed tanks filled with milk of lime.

Later we have other "Milk of Lime" systems, so called dump systems like the Three Tank, the Drewsen and the Stebbins; then again the continuous system, like the Burgess, the Barker and many modifications of the same. In all of these except the Drewsen, the Vacuum principle is utilized. The Drewsen worked on the principle of absorbing the gas in a spray of limewater using a fan to force the gas through the system.

In the meantime, we also find scattered installations of many short lime stone towers where the acid is pumped in series from one tower to the next. This brings us up to about 1910 when the medium high tower appeared and the concrete construction is coming into use.

About 1914 the Jenssen towers first were brought out, being of reinforced concrete lined with glazed tile. This system can be reversed and is therefore self cleaning. Today about half of the acid in this country and Canada is made by these towers, about 20% by other towers and about 30% by Milk of Lime. The "Mike of Lime" systems are now being replaced by Jenssen towers at the rate of one each month, and here is where I prophesy: Within four years, the "Milk of Lime" systems will be rare. The reason for this is the simplicity of operation of the tower system in connection with great savings in chemicals, power, repair and labor and mainly the fact that the chemical reaction taking place in a Limestone tower is different and more favorable than that in a "Milk of Lime" system. In a "Milk of Lime" system, there is first formed Calcium-monosulphite which is insoluble and later is dissolved by an excess of free SO_2; the acid is clearing up. During the formation of monosulphite, there is a steady precipitation of this salt in the system and this will of course all be dissolved in case everything goes well. But as we all know, this is not the case and most of us have had to clean out plugged openings and pipes in the middle of the week more than once. The principle of the Stone system is different, in as much as the free SO_2 is always in excess and works on the limestone dissolving this directly without the formation of monosulphite. The acid is therefore always clear and no plugging can possibly happen. It is also a fact that for thermo-chemical reasons too lengthy to go into at this time, the acid made by the towers is 12° F. colder than acid from "Milk of Lime," all other conditions being equal.

The use of Pyrites and Sulphur is known to all. In Europe where Sulphur is expensive, the Pyrites is used almost entirely, while in this country, with cheap Sulphur, the Pyrites is not used in any mill to my knowledge. Lately we hear some talk of liquid SO_2. The use of this is entirely possible and would be a great advantage in acid making, as it would eliminate coolers and get us away from Sulphate formation caused by weak gas. It is just a matter of working out a cheap method for separating, cleaning and compressing this gas as it comes from the chimneys of the smelters at a price which can compete with Sulphur.

We have, so far, talked only of the manufacture of raw acid or system acid, if you please. What we really are after, however, is a suitable cooking acid or reclaimed acid. We all remember the time when the relief liquor and gas from the digesters were wasted and the Sulphur consumption run around

500 lbs. per ton of Sulphite. The first attempt to reclaim this relief and utilize the SO_2 released during the cooking operation was probably done by Dr. Vigo Drewsen who worked this out in a mill in Norway way back in the early 90s. He deserves great credit for his work, and was instrumental in introducing his separator and general scheme of reclaiming in the American mills about 25 years ago. The result has been that today an up-to-date Sulphite Mill is as sweet smelling as any other manufacturing plant, and the health-wrecking jobs around the acid plant and digester building of early days are something of the past. The use of the separator is done away with in many plants, and all relief is returned to the storage and reclaiming tanks. Some mills, however, especially those making easy bleaching pulp, prefer to separate out the last part of the liquor, figuring that they can save bleach powder and obtain a better pulp by so doing.

It would probably not be amiss to talk a little about the use of strong and weak acid. Personally, I have made sulphite pulp with acid testing 3.00% total, 2.00% free and 1.00% combined and with acid as high as 7-6-1 and with all acids in between, and I have been told that Sulphite has been made with acid as strong as 9-8-1. The question is if there is any great advantage in using such exceedingly high acid. One thing is sure; namely, that a high acid is hard on digester linings and fittings, and it is a fact that after two hours duration the strength of acid in two digesters, one with weak and one with strong acid, are nearly the same if the proper care is taken in operating the cook. Strong acid looks good in print and shows that the mill is in good physical condition, otherwise the acid could not be built up as high, but, personally, I prefer a medium acid of say, 5-4-1, and I very much doubt if we really can get a higher yield and better pulp by such extreme strength of the cooking acid.

As I have said on previous occasions, the acid, and when I say acid, I mean cooking acid, is not made in the acid system alone. A good acid system is of course essential for practical and economical reasons but proper relief from the digester, proper cooling, proper absorption in the storage tank; in other words, proper reclaiming is the deciding factor and the success of acid making will be decided by the way all these things are done.

The way I look at "The Future of Acid Making" is that we will continue to use Limestone as a base, because it is the cheapest and the best. The advantages from the use of liquid SO_2 are so many that it will gradually eliminate sulphur. The heat bound by the evaporation of liquid SO_2 will be utilized for cooling of relief gases if necessary. We will get away from wooden storage and reclaiming tanks and use brick lined iron vessels able to stand digester pressure. The gas and liquor from the digesters will not be cooled as it is today, as we, no doubt, will pre-heat the cooking acid before it enters the digester. The advantages of this pre-heating both as to quantity and quality of pulp will be so many that it will practically revolutionize the process of sulphite manufacturing. This is a matter which will come to your knowledge before very long.

Fire Extinguishment

Prepared by the Engineering Department of the National Safety Council

PRACTICALLY every fire can be extinguished within the first five minutes if proper equipment is brought into use, by men who know how to use it. Successful extinguishment of fires does not, in general, require elaborate, expensive, equipment; the essentials are the right kind of equipment (suited to the existing hazards), kept in good condition, in the right place, with men who know how to use it, and that it be brought into use immediately after the fire starts.

No matter how well equipped a plant is with fire-fighting apparatus, nor how well trained the men may be to handle this apparatus, it is of the utmost importance that the public fire department be notified immediately when fire is discovered, in addition to the efforts with private equipment. When men rely wholly upon their own ability to extinguish small fires, serious losses often result which could have been prevented had the public fire department been notified promptly.

Sprinklers

The automatic sprinkler is considered the most important of all fire-extinguishing apparatus. The design and installation of sprinkler systems cannot be described in this brief article.

When painting or calcimining the ceiling or overhead piping, it is advisable to cover each sprinkler head with a small paper sack, care being taken to remove such sacks when the work is done. Paint may so affect the sensitiveness of the solder that heads will not operate except at a much higher temperature than intended.

Water shut off from sprinkler pipes is the most frequent cause of unsatisfactory control of fire by automatic sprinkler systems. Inspections often reveal that the control valves are closed, and that, therefore, the sprinklers would be practically valueless in case of fire. A safeguard against this contingency is to seal or strap the water control valves in open position; this will tend to prevent malicious

or careless closing of the valves. An electrical signaling device which, whenever the normal position of any valves is disturbed, will automatically signal a central control station, is also an efficient safeguard against closed valves.

Another very serious condition which often results in the failure of sprinklers efficiently to control a fire is caused by the piling of stock, and building of shelving and partitions too close to the sprinkler heads, so that they obstruct the proper distribution of water over the surrounding area. At least twenty-four inches clear space should be maintained below the sprinklers so that an effective spray action of the heads will be possible.

Hose

It is almost impossible to tell good from bad rubber-lined hose when it is new, either from its appearance or by putting it under pressure. It is recommended therefore that only hose bearing the label of approval of Underwriters' Laboratories be purchased.

The high cost of good hose and the importance of its being in good condition at all times demand that it be given the best of care. Hose should not be kept in a pump house, boiler house, or other warm place, as rubber quickly deteriorates under such conditions. Where hose is folded on shelves or racks it should be changed from time to time with bends at different points to prevent cracking.

Water Pails

Cone or round bottom pails are preferred by many, as they are less likely to be used for other purposes. The flat-bottom pail (bucket) of about three gallons capacity is, however, recommended, for if an employee carries two pails to a fire he may set one down while he empties the other. Fire pails, water barrels, and water casks should be painted red with the word "Fire" in white letters on them. Their use for purposes other than fire-fighting should be strictly prohibited.

Soda-Acid Extinguishers

The soda-acid extinguisher in common use employs a solution of about a pound and a half of bicorbonate of soda to two and a half gallons of water, with an inner container of approximately four ounces of sulphuric acid. These are made in the "loose stopple" and the "break bottle" types. The latter are especially adapted for railroad and boat service where the swaying and rocking would splash the acid over into the soda solution thus rendering it useless. By inverting the extinguisher, or breaking the bottle, the acid is emptied into the soda solution, forming a gas the expansion of which forces out the solution under considerable pressure.

These extinguishers are valuable in free-burning fires where there is much draught. They are also of value in fighting fire on ceilings or between walls where it cannot be reached by fire pails. Sizes larger than two and one-half gallons capacity are not recommended because of the inconvenience in handling.

Soda-acid extinguishers must be protected against freezing and for this reason are of little value in locations where protracted cold spells prevail unless they are kept heated. Cabinets (felt or asbestos lined) containing a small electric light beneath the extinguisher, will be adequate protection against the cold. A red glass in door of cabinet, through which light may be seen, will serve to mark the location of the extinguisher box. Calcium chloride cannot be used in the soda-acid extinguisher, as it reacts with the soda. The use of salt is not advisable because a cold extinguisher of this type does not operate efficiently, and also because the salt will crystallize on the sides and may corrode the extinguisher. These crystals are apt to clog the outlet, thus causing the weakened tank to explode when used. The soda solution also may form crystals on the inside wall of the extinguishers, and, for this reason, they should be examined occasionally to see that this condition does not exist.

The acid in the extinguisher constantly absorbs water and, in time, enough water may be absorbed to cause the acid bottle to run over, and acid dropping into the tank will eat into the side of tank around water line. It is advisable, then, that new acid be placed in the bottle once each year when extinguisher is recharged.

Soda-acid extinguishers should be recharged at least once a year. They should be emptied by inverting and playing through the hose as if on a fire, to insure the operation of the extinguisher and also to give employees an opportunity to see how they are operated. Before recharging, the hose and the extinguisher tank should be throughly washed.

Carbon Tetrachloride Extinguishers

Carbon tetrachloride when heated to about 200 degrees F. is transformed into a gas heavier than air. When thrown on a fire the gas surrounds the fire area, keeping out the air and oxygen, and tends to smother the fire. As the extinguishing value of carbon tetrachloride depends on the smothering effect of the gas, these extinguishers are of little value where there is a wind or other air current which will carry the gas away from the fire. A fire in freely-burning material, such as wood or paper, quickly creates a strong draft of air inward and upward, and such fires are difficult to extinguish with carbon tetrachloride except when they are very small. This type of extinguisher is useful however for reaching fires in partitions, and other concealed spaces.

Extinguishers containing this fluid are of particular value for electric fires, as the carbon tetrachloride is a non-conductor of electricity and will

not injure electrical apparatus. The stream may be directed on the commutator of a dynamo without danger to operator or dynamo. Carbon tetrachloride extinguishers are recommended for all electric cranes, at motors (wherever located), and at convenient points in power houses.

Carbon tetrachloride does not deteriorate with age, nor freeze at usual temperatures, and if mixed with a small per cent of certain other ingredients will withstand a temperature of 50 degrees below zero.

Although there is question whether or not the gas itself is harmful, there are instances where persons have been overcome while using the extinguishers.

Carbon tetrachloride extinguishers should be tested periodically to see that the pump has not gummed, which would interfere with its free action. It is suggested that twice each year all extinguishers be tested by discharging (by pumping) all the contents into a pail. The pump should then be operated vigorously to make sure that it works freely, and that the packing is flexible. Then the fluid should be replaced, a little being added to fill the tank. Particular care must be taken that no water becomes mixed with carbon tetrachloride used in extinguishers, as water will reduce its non-conductivity.

Sawdust and Soda

A mixture of sawdust and bicarbonate of soda (about 10 pounds of soda to a bushel of sawdust) is a valuable extinguishing agent in fires of inflammable liquids. This mixture floats on the surface of the burning liquid, shutting off the oxygen supply and smothering the fire. It is much more effective than sand in putting out fires of inflammable liquids. Unless foam extinguishers are provided, a supply of sawdust and soda should be kept on hand at all containers of varnishes, lacquers, oils, paints, and similar liquids. The principal point in its favor is its low cost.

Suggestions

The efficiency of fire-fighting apparatus depends largely upon its proper use. Unless the hose stream, the extinguishing fluid, sand, or sawdust is directed on the base of the fire, its value is lost. Employees should be instructed in the proper use of all equipment, and given an occasional opportunity of seeing it in actual operation.

Fire extinguishers and fire hose racks are sometimes found inaccessible on account of material stacked in front of them. It is also a fact that the employees in many plants do not know where the fire apparatus is located. To be of value such apparatus must be put into use immediately after fire is discovered. It should, therefore, be placed prominently and kept easily accessible—if not, it might as well not be provided at all. Some plants place extinquishers along center aisles with a red mark on floor or around column or post on which extinguisher is hung, and often with a red light over it at night.

Inspection should be made of all fire-fighting apparatus including extinguishers, fire barrels and pails, hose, hydrants, and valves, at least once each week. Many of the large companies require such inspection every day. A competent man should be assigned to this inspection service, and should periodically make a complete and detailed inspection of all apparatus and equipment, keeping a record of the inspection on a blank for that purpose.

Purposes of inspection are to determine (a) what possibilities of fire outbreak can be eliminated, (b) whether fire-fighting equipment and apparatus is in good condition and accessible.

It has often been the case that extinguishers were found empty when most needed. In order to know at a glance whether an extinguisher has been tampered with, through mischief or maliciously, some companies use a car seal to fasten handle of extinguisher to hanger bracket. These seals are easily broken, and therefore do not interfere with use of the extinguisher. They are, however, not replaceable, and hence enable the inspector to know whether extinguishers have been disturbed for any reason.

It has often been stated that there have been very few changes in paper making machinery for many years and this talk has been directed largely to the type of beating or Holland engines. The illustration herewith shows something radically different from the ordinary type of beating engine. It is being brought out by the Valley Iron Works Company, at Appleton, Wisconsin, and although occupying the same floor space as the ordinary one thousand pound beater, the manufacturers claim it will handle over two thousand pounds of dry stock worked at a consistency of eight per cent, at the rate of nine-five feet a minute, or sixty tons a day, which is many times as fast as the ordinary beater will do the work.

This new beater is called the "Niagara" and the great savings claimed for it is in the cost of installation—one beater will take the place of a number of others—time of beating, floor space, power, number of motors, amount of belting and labor to handle the work. It is said that one of these beaters is now furnishing all of the stock for a one hundred and thirty-two inch machine, and that it is necessary to run it only part of the time. The manufacturers would no doubt be glad to give further information about this new type of beating engine.

A man's head is like a stranger's valise: People wouldn't know how little there is in it if he weren't always opening it.—Douglas Malloch.

Power House Instruments

Comparisons Between CO_2 Apparatus and Other Instruments for the Control of the Utilization of Fuel in the Power Plant

By TELLANDER HARGER

AMONG the instruments that have found wide application in the boiler plant, are the ordinary coal scale, water and steam meter, draft gauge, thermometer, pyrometer and the gas analysis instrument. It is surprising, however, to note how little the application of these instruments is understood and appreciated by the average engineer, how little he realizes the fundamental application of the same to the plant which is under his control. This is particularly true with regard to gas analysis instruments about which he seems to have an entirely wrong idea. The CO_2 Recorder in order to be of real value to the plant operator must be thoroughly understood and the construction of the same is certainly simple enough. Lack of interest on the part of the man in charge is the only reason why so many of the CO_2 Recorders installed are not in working order; not because the instrument chosen was of inferior type—all CO_2 Recorders are good—but merely because the little time which is required to keep this important instrument in good working order has not been "available." A CO_2 apparatus is a hundred precent investment, and in order to clear up erroneous opinions concerning the same, the following thoughts are herewith presented.

It must be distinctly understood that there are two methods of establishing furnace control for the economical combustion of fuels; viz, the direct method and the indirect method

Indirect Method

The quantity of heat utilized—i. e., the evaporative value of the fuel—is determined by weighing the fuel and measuring of the water evaporated. It is generally used for ascertaining the efficiency of a particular boiler and is called the evaporative test. The same must be made by two or more capable engineers with a great deal of care and by observing certain, very strict rules and regulations laid down by a body of experts. This test is usually of short duration and shows up the boiler at its best, because the men firing the boilers usually put up heroic efforts to make the result as good as possible.

An analytical determination of the heating value of the fuel must always precede such test, as well as a knowledge of the nature of fuel used; i. e., its percentage of moisture, ash, volatile matter, etc. However, the heating value of fuel changes from day to day, and as the determination of the same is an operation that can only be made by skilled specialists, requiring delicate calorimetric instruments to accomplish accurate results, determination of fuel values can never be employed for continuous control of service. Thus, in order to obtain any results of real value, one is confined to finding the quantity of total water evaporated per total pounds of fuel burnt, and in this manner obtain an approximate measure of the utilization of fuel for the entire plant. A quite reliable method for the measuring of the water fed to the boilers does not yet exist, as the rate of flow of the boiler feed is very irregular and varies continually. Thus, the recorded amounts of water evaporated shown by either water—or steam meter are in most cases only approximate—or only very nearly correct. Finally, such controlling procedure, even in the most favorable instances, can only show results covering operation of the complete plant, but does not show or indicate the "character" or faults of the individual unit nor can it locate same or point means and ways to their correction. While undoubtedly very fine results have been obtained in this manner and much fuel has been saved, this method can never result in a maximum utilization of fuel, but serves more or less as an indicator for the production of steam and the load of the boilers rather than for obtaining any effective over the rational use of the fuel.

The manner of application and deflection of coal meters, water meters, respectively steam meters which form the essentials for such a control system, may thus be considered reduced to their true value.

Moreover, when using the indirect method of ascertaining the utilization of the fuel, principally the losses in the boiler plant, the so-called chimney taken for granted that the remainder must be the quantity of heat actually utilized. Of the many losses in the boiler plant, the so-called **chimney** losses (not counting exceptional cases) are of the most important, and therefore, the indirect method is limited for practical use to bring a check on keeping the losses as insignificant as possible.

Chimney Losses

The cause for the presence of chimney losses is partly due to the fact that the flue gases are too hot when passing out through the chimney; partly, that they contain combustible gases which are allowed to escape unburnt. In order to reduce the chimney losses to a minimum, the fuel must be burnt with the lowest possible quantity of air, and the heat of

the flue gases must be utilized in such a manner that they pass to the chimney with the lowest possible temperature. In this manner, the loss due to incomplete combustion is avoided and the loss of heat in the escaping flue gases is reduced to a minimum.

The chimney losses consequently are governed by: (1) the quantity of the flue gas. (2) the per-

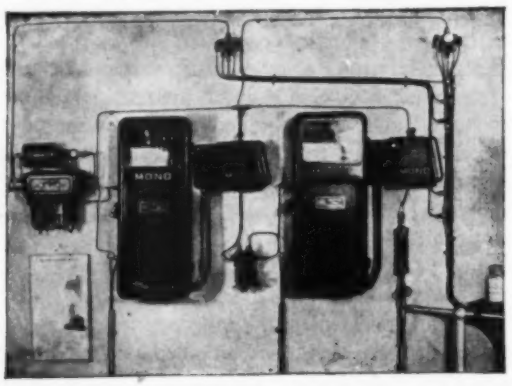

Fig. 1—The photo above shows an installation in a boiler room which makes absolutely complete furnace control possible. CO_2 and $(CO + CH_4)$ are recorded simultaneously

centage of combustible gases. (3) the exit temperature of the flue gases.

The first two factors depend principally upon the work of the firemen, while the other factor has a great deal to do with the boiler load. The determination of all the three factors is necessary to establish the chimney losses, but only THE FIRST TWO FACTORS CAN SHOW IF THE FIRING HAS BEEN DONE RATIONALLY.

The instruments which are commonly used for the determination of the chimney losses are the draft gauge, the thermometer and the CO_2 Recorder. The best draft gauge are of the so-called differential type, measuring the resistance with which the flue gases meet in their passage through the boiler setting and are connected under the grate as well as at the damper.

Evidently, the greater the air supply and the quantity of the flue gases, the greater the resistance through the boiler, and vice versa, assuming, of course, that other factors which must be taken into consideration are quite the same. However, it is totally wrong to draw herefrom the conclusion, that a certain difference of draft corresponds to a certain air supply, because the resistance through the boiler varies with the height of the fuel and, above all, with clinker and soot formations. For calculation of the air admitted to support combustion and the quantity of flue gases produced, therefore, the draft gauge is a very imperfect instrument which will never indicate whether the air supply is economical or not.

As to the thermometer, it may be pointed out, that single temperature observations of the flue gases are entirely worthless, because the temperature of these gases varies with the load as well as with the quantity of air admitted to the furnace, and also with that of the infiltrated (false) air, entering through the boiler setting. The thermometer is only then of real value when the quantity of flue gases is recorded with the aid of Combustion Recorders.

Only in this connection does it give the temperature observation required for an exact estimation of the losses of heat in the exit gases, and, therefore, the thermometer can be usefully employed to ascertain if the boiler is loaded economically or not.

Fig. 1.—The photo above shows an installation in a boiler room which makes absolutely complete furnace control possible. (CO_2 and $CO+CH_4$) are recorded simultaneously.

It is well known that the quantity of the flue gases can be recorded by analysing chemically the percentage of carbon dioxide in the same, and, accordingly, CONTINUAL AUTOMATICAL ANALYSES OF THE PERCENTAGE OF CARBON DIOXIDE TOGETHER WITH THE PERCENTAGE OF COMBUSTIBLE GASES WILL GIVE COMPLETE AND

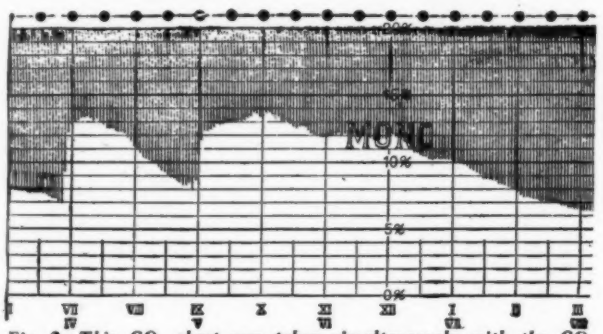

Fig. 2—This CO_2 chart was taken simultaneously with the CO chart below

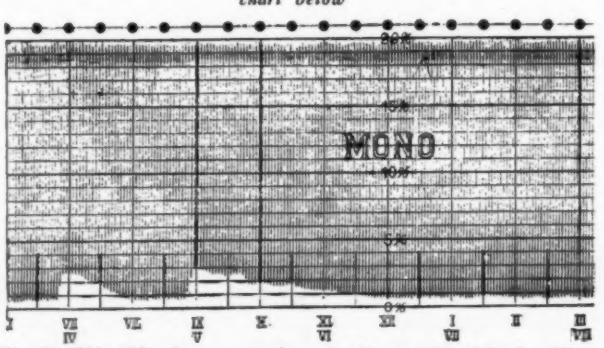

Fig. 3—This CO chart was taken simultaneously with the CO_2 chart above

QUITE RELIABLE DIRECT CONTROL OF FURNACE CONDITIONS. An apparatus, therefore, which gives this automatic record of the analyses of both these gases becomes a valuable power house instrument.

A lot of oil in one place and no oil at another is a bad combination. All parts should have sufficient oil.

Pulping of Second Cut Cotton Linters

Some Further Mill Trials

By OTTO KRESS[1] AND SIDNEY D. WELLS[2]

IN June, 1919, one of the writers of this paper gave a brief talk at the Convention of the Interstate Cotton Seed Crushers Association at New Orleans, on the possible use of second cut cotton linters and cotton hull fibre for paper purposes. As a result of this talk, a linter and hull fibre committee for developing new uses for cotton linters was appointed, and the laboratory agreed to conduct some pulping trials on a shipment to be furnished free of charge by the Association. Arrangements were made with the Mead Pulp and Paper Company, Chillicothe, Ohio, through whose courtesy permission was obtained for these trials. A shipment of second cut linters was accordingly made by the linter committee from the Grenada Oil Mill, Grenada, Mississippi, which was described as representing a 60 pound second cut after a 40 pound mattress cut, and which could probably be furnished in large quantities at around two cents per pound. An examination of the raw stock indicated an absence of cinders or dirt and the presence of a small percentage of hull fragments that could readily be removed by pulping.

In view of the present abnormal demand for pulp and paper, but two pulping trials and one paper machine run were made in order to avoid as far as possible interference with the ordinary mill operation and consequent loss of production.

Cook No. 1

The cook was made in a regular stationary upright soda digester (8 feet x 28 feet) fitted with a steam injector for circulation and also with a direct steam line. The digester was furnished with 1,100 gallons of white liquor of a concentration of 30.5 g. p. l. to which was added 2,960 lbs. of air dry fibre (89.8 per cent bone dry). Further white liquor was then added to bring the total volume to 1,800 gallons. The stock floated on the liquor filling the digester to approximately one-half of its capacity, and, due to a leak in the steam pipe, the injector did not properly circulate the cooking liquor. Approximately 1,800 gallons of water were added reducing the final concentration of the cooking liquor to 15.1 g. p. l. The digester was then brought to pressure in the usual manner in one hour, being frequently relieved to remove the gases produced, and held at 100 lbs. maximum pressure for three and three-quarters hours. Just before blowing, additional black liquor was pumped into the digester to assist in blowing, but approximately 20 per cent of the cook remained in the digester, requiring two reblows. In this cook, 17.1 lbs. NaOH was used per 100 lbs. bone dry fibre, and the resulting black liquor showed an efficiency in alkali consumption of 57.2 per cent indicating that but 9.8 lbs. of NaOH had been used per 100 lbs. bone dry fibre.

Cook No. 2

In cook No. 2, there was used per 100 lbs. bone dry fibre 10.75 lbs. NaOH and 87 gallons of cooking liquor of a concentration of 14.8 g. p. l. The digester was raised to pressure in one-half hour and held five hours at 105 lbs. per square inch. In view of the decided reduction in the amount of active alkali used, it was considered advisable to give this long time of pulping to insure complete cooking, but probably a saving in time of two hours could have been made. Prior to blowing, black liquor was pumped into the digester resulting in a clean blow.

The pulp from cook No. 2 was pumped to a Bellmer bleacher, but as the trials were seriously interfering with the mill production, the stock was allowed to run to waste as there was no means available for saving and holding it. Several hundred pounds of the unbleached unbeaten stock were pressed and shipped to the laboratory for bleaching and making into paper.

The general pulping data for these two runs are given in take 1.

In both of the cooks, in view of the high yield of pulp expected, it was not considered advisable to fill the digester with fibre, as, otherwise, the pulp would have overfilled the wash pan. Further, it was considered inadvisable to attempt to fill the digester to capacity and interrupt the blowing so as to discharge from the balloon intermittently into two or more wash pans.

The pulp was washed in the usual manner, hosed to the stock chest and pumped directly to a Bellmer bleacher. At the Mead mill, the practice is to pump the soda pulp to flat diaphragm screens, then to a stock thickener preliminary to dropping it into the bleacher. In view of the length of the fibre of the cotton stock, the screens had to be by-passed, and the stock pumped to the Bellmer in a very dilute condition. In view of this dilution, an excess of bleach had to be used with heat and the addition of acid to bring the pulp to a high degree of white. There is no question that this bleaching treatment injured and weakened the fibre as was proven at the

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laboratory by comparing paper machine trials on pulp from cook No. 1 bleached at the will with pulp from cook No. 2 bleached and aged in a drainer at the Madison laboratory.

Paper Run

Bleached cotton pulp from run No. 1 was pumped to two 1,800 lbs. beaters which were furnished as follows:

Beater Furnish

Cotton linters	60 per cent
Old papers	40 per cent
China clay	350 lbs.
Rosin size	35 lbs.
Starch	55 lbs.
Alum	80 lbs.

The stock after beating was run into lithograph paper, no difficulties being experienced on the paper machine or in supercalendering. As the cotton stock had been weakened by over-bleaching, and subsequently weakened by cutting rather than brushing in the beater, no strength tests have been made on the paper produced. The strength tests on the pulps made at the Mead Pulp and Paper Company are based on the paper runs made at the laboratory. As already mentioned, only one paper run was made, as this trial interfered seriously with the mill production.

Trials Made at the Forest Products Laboratory, Madison, Wisconsin

Small samples of the unbleached pulp produced at the Mead mill were tested for bleach consumption, results indicating that the stock for cook No. 1 could be bleached to a high white with 5 per cent of bleaching powder (35 per cent available chlorine), while pulp from cook No. 2 required 4 per cent bleaching powder.

Microscopic examination for fibre length of unbleached pulp from cook No. 2 gave 50 determinations the following data:

Average fibre length	2.66 m.m.
Longest fibre length	7.68 m.m.
Shortest fibre	.64 m.m.

If measurements had been made on bleached and washed pulp, we believe that on account of the removal of the smaller fragments by the drum washer the average fibre length would have exceeded 3 m.m.

Stock from cook N. 1 which was bleached at the Mead mill and unbleached stock from cook No. 2 bleached at the Madison laboratory were run over the experimental paper machine, and some sheets of the paper made from cook No. 2 were tub sized with glue. As can be noted from table II under the heading, "Points per Pound," the stock bleached at the laboratory has double the strength of the stock over bleached at the mill, while the tub sized stock has practically three times the strength of the paper made from the pulp bleached at the mill.

It is to be noted that the points per pound are based on a 24x36/500 basis so that a test of .52 is equivalent to 1.19 points per pound on a 17x22/500 20 lb. folio basis.

TABLE II

Strength Tests on Papers Made from Cooks No. 1 and No. 2

	Weight, 24x36/500, pounds	Bursting strength, pounds	Points per pound, 24x36/500, bas.	Average breaking length, meters	Average folding strength, number	Stretch, per cent
Stock bleached at Mead mill.	40.5	7.0	.176	2433	2.0	1.84
Stock bleached at Madison...	43.5	14.6	.336	3419	20.5	3.20
Stock bleached at Madison, tub sized	45.5	23.6	.519	4381	51.6	2.79

As it was impossible to obtain yield figures on either of the cooks made at the Mead mill, trials were made at the laboratory on some of the raw stock typical of this shipment.

The general cooking conditions were as follows:

	Cook 3	Cook 4	Cook 5
Cooking chemical..	9.73# NaOH	8.83# NaOH†	8.13# $Ca(OH)_2$
For 100 lbs. raw linters	†	1.80# Na_2CO_3 5.97# $Mg(OH)_2$ 11.03# CaCO	5.74# $Mg(OH)_2$ 15.8# Sulphur
Cooking liquor per 100 lbs. raw linters	80.3 gal.	80.3 gal.	80.3 gal.
Maximum steam pressure, lbs. per square inch	75	95	75
Time to pressure..	2¼ hrs.	1¾ hrs.	1¼ hrs.
Time at pressure..	5 hrs.	5 hrs.	4 hrs.
Ratio combined soda to total soda in black liquor..	76.6	91.9	———
Yield of bone dry pulp	84.0	82.0 (a)	119.6 (b)
Bleach consumption, per cent....	3	2	———

† The cooking liquor was prepared by adding 13.5 lbs. Na_2CO_3 and 10.3 lbs. of lime to the digester (after slacking), the lime analyzing 60 per cent CaO and 40 per cent MgO. The cooking liquor as given for cook No. 4 was obtained during the cook by the causticization of the soda ash.

* About 20 pounds' pressure in excess of steam pressure (as calculated from the temperature readings) was apparent throughout the cook which could not be blown down with a reasonable relief of the gas blow-off line.

(a) Yield determined with bone dry weight sample which had lost some fine pulp in washing it free from lime residues. The yield figure is a trifle lower than it would have been if determined similarly to cook No. 3, yield of paper 73.4 per cent. Cook No. 3 practically duplicates cook No. 2 as made at the Mead mill.

(b) Pulp contained considerable insoluble matter later removed with drum washer. Yield of paper 90.3 per cent.

Cook No. 4 was made with the object of determining whether it might be possible to use a mixture of lime and soda ash instead of using the more expensive caustic soda. By this procedure, the fibre is probably not exposed at the beginning of the cook to the full strength of the caustic soda, but as the digestion proceeds, the soda ash is gradually caustized with formation of the active caustic soda. As can be noted from table III, the strength of the resulting pulp was increased while the stock was considerably hardened. Both cooks No. 3 and 4 were

completely pulped showing no hull fragments or dirt. Cook No. 4 on which a yield of 82 per cent of bone dry pulp was obtained was bleached similar to cook 3 in the beater and allowed to lie in the drainer for 48 hours to develop a high white color. After suitable beating, it was run over the experimental machine showing a final yield of finished cotton fibre was destroyed and appeared as fine fragments that stained brown with Herzberg's reagent and would not stain red, similar to ordinary cotton stock with Herzber's reagent. On reblowing the balance of the cook that remained in the digester, it also broke down into a fine mud that passed through the perforated drainer bottom of the blow

TABLE 1.
COOKING DATA ON COTTON LINTER COOKS AT MEAD MILL.

	Air dry Weight Lbs.	B. D. Weight Lbs.	Total NaOH Lbs.	NaO per 100 lbs. B. D. cotton Lbs.	Causticity %	white liquor G. P. L.	Liquor volume Gals.	Water added Gals.	Total volume cooking liquor Gals.	Conc. cooking liquor G. P. L.
Cook No. 1	2960	2664	457	17.1	92	30.5	1800	1800	3635	15.1
Cook No. 2	3091	2790	300	10.7	95	15.	2400	....	2436	14.8

	Vol. cooking liquor per 100 lbs. B. D. cotton Gals.	Max. steam pressure No. per sq. in.	Time coming to pressure Hours	Time at Max. pres. Hours	Active alkali in black liquor %	Eff. of alkali consumption %
Cook No. 1	123	100	1.0	3.75	42.8	57.2
Cook No. 2	87	105	.5	5.00	16.9	83.1

bone dry paper of 73.4 per cent based on the bone dry weight of the original fibre.

Cook No. 5 was made with a mixture of lime and sulphur in proportion to form calcium polysulphide. The resulting pulp showed some incompletely cooked hull fragments which did not bleach to a high degree of white.

TABLE III

Cook No.	Treatment	Weight per ream 24x36/500, lbs.	Thickness, inch	Bursting strength, lbs. sq. in.	Points per pound, 24x36/500	Average breaking length, meters	Average folding, straight folds	Average stretch, per cent
3	Calendered	42.5	.0034	11.5	.271	2880	15	2.53
4	Calendered	44.5	.0036	15.3	.342	3390	63	3.28
4	Tub sized	38.5	.0036	29.4	.766	5070	258	5.27
5	Uncalendered	55.5	.0050	23.0	.414	4020	185	4.53
5	Calendered	43.9	.0032	16.5	.376	3550	144	3.84

An attempt was made to pulp linters by the sulphite process to determine whether it would be possible to pulp out the hull fragments. The linters were given a very drastic pulping treatment in a semi-commercial 100 lb. sulphite digester using a cooking liquor of 6.22 per cent total sulphur dioxide, 5.08 per cent free and 1.14 per cent combined sulphur dioxide. After the first hour of the cook, heating was done by indirect steam, and circulation insured by means of a pump. A temperature of 100° C. was reached in a little over one hour and 100 lbs. pressure in three hours. The final temperature was 153° C. and the final pressure 70 lbs. leaving 10 lbs. gas pressure in the digester at the time of blowing. The total time of cook was 7½ hours. On blowing the cook, over two-thirds of the charge remained in the digester, while the portion blown had been so overcooked that it all passed through the perforated drainer bottom of the blow pit in the form of a fine mud. The hull fragments were not pulped and appeared unchanged under the microscope, while the pit in the form of a mud carrying with it the unattacked hull fragments. Bleaching trials indicated that the hull fragments had been unattacked as they could not be lightened in color.

Conclusions

Second cut cotton linters can be prepared free from all dirt such as cinders provided the proper precautions are taken in handling the seed and fibre at the oil mill. This is of extreme importance as foreign dirt, such as cinders, if once mixed with the linters cannot be entirely removed by mechanical or chemical means, and find their way into the finished pulp and appear in the paper as minute specks detracting from the appearance and value of the finished sheet. This dirt has to date been one of the decided drawbacks to the use of linters which have been too dirty for use in paper manufacture.

Second cut cotton linters similar to the shipment as made by the Interstate Cotton Seed Crushers' Association can be pulped with the ordinary soda pulp equipment with an economical chemical consumption not to exceed 10 lbs. of caustic soda per 100 lbs. of bone dry fibre. This represents less than one-half the chemical required in the reduction of wood.

Cotton linter pulp can be economically bleached with 2 per cent of 35 per cent available bleaching powder which is less than one-sixth the bleach required by the ordinary wood pulp.

Second cut cotton linters are far superior to cotton hull fibre for pulp and paper purposes*, the chief advantage being as follows:

1. Increased yield of pulp of from 15 to 20 per cent based on the weight of the bone dry fibre. This increase in yield is caused by a much lower per-

* *See report of Otto Kress and Sidney D. Wells, "The Suitability of Second Cut Cotton Linters"—The Paper Industry, July, 1919, also report of Otto Kress, "Cooking Cotton Hull Fibre for Pulp" —Paper, Jan. 21 and 29, 1920.*

(*Continued on page* 460)

Standard Sizes for Shafting

Committee of the A. S. M. E. Recommends 14 Sizes of Transmission Shafting and Large Reduction in Number of Sizes of Machinery Shafting

THE desirability of reducing the number of sizes of shafting and in consequence the number of parts of power-transmission equipment that must be carried in stock has long been recognized. It remained for the conditions of the war, however, to bring about definite action in this regard, from the standpoint of the conservation of materials. The activities of the Committee of the American Society of Mechanical Engineers on War Industries Readjustment brought to light the fact that an immense amount of steel is continuously tied up in manufacturers' and dealers' stocks of shafting and that a corresponding amount of cast iron is also held in stock in the form of hangers, bearings, couplings, collars, bushings, pulleys, etc. At the suggestion of the chairman of the Committee on War Industries Readjustment, therefore, a committee was formed to investigate the subject of the standardization of shafting sizes. The personnel of this committee is as follows:

Cloyd M. Chapman, chairman.
Hunter Morrison.
Russell E. Nelles.
Geo. N. Van Derhoef.
Louis W. Williams.

This committee was confronted with two distinct but closely related problems, viz., the standardization of the diameters of shafting used for the transmission of power, such as lineshafts, countershafts, etc., and the standardization of the diameters of shafting used by machinery manufacturers in making up their products. The first of these problems seemed to be the simpler of the two. While a large number of sizes of transmission shafting are now listed and stocked, it was believed that a comparatively few of these are in extensive general use. Accordingly, a letter was sent to 36 of the largest manufacturers and dealers in transmission shafting asking for statistics on the consumption of each size of shafting handled by them. Some 20 of the largest concerns in the industry furnished complete statements of their sales over periods of time chosen by themselves. These data were reduced by the committee to a uniform basis of percentages. The amount of each size sold was expressed as a percentage of the total sales, both on a weight basis and on a lineal-foot basis. From these data, plotted in the form of a diagram, it was very evident which of the sizes were popular and generally used and which were more rarely called for. A tentative list of 12 sizes was prepared from this diagram and sent to forty-six other dealers in transmission shafting and shafting supplies from whom twenty replies were received.

In the letters to these firms, the committee expressed the opinion that the custom of using shafting $\frac{1}{16}$ in. under the unit sizes is so firmly and so nearly universally established in this country, that it would be unwise to attempt to adopt sizes in even inches and fractions as standard. It was pointed out, also, that certain sizes stand out preëminently as "popular sizes" and that others are sold in relatively small quantities. It seemed very feasible to select a series of standard sizes which would meet the popular demand and give a sufficient selection of sizes for general purposes and at the same time reduce the number of sizes now listed by the trade from some 50 or 60 down to 12 or 15.

Plan Is Approved

The response to these letters was hearty and practically unanimous in opinion. The transmission-shafting users and dealers, almost to the last one, approved the plan of standardization and the sizes suggested were very generally approved except that the diameters $1\frac{11}{16}$ in. and $2\frac{3}{16}$ in. were in many cases requested to be included. After due consideration the committee decided to include these two sizes in the original list, making the 14 size now adopted as standard.

The second problem was a more intricate one. The number of sizes now produced by the rolling mills for use in machinery is very large. Almost every sixty-fourth of every inch up to three inches is drawn. This means excessive equipment at the mills and large stocks in the warehouses. If a reasonable number of these sizes could be eliminated or classed as "Specials" and a comparatively few sizes selected as standard or stock sizes, a great saving would thus be effected and a valuable service performed.

In order to get the opinions of leading consumers of shafting for machinery purposes, the committee decided to lay the plan before some 225 large consumers of this material and invite their comment upon its desirability or feasibility and their advice as to the size interval between standard diameters which should be considered. It was explained that it was not intended that the adoption of certain sizes as standard should make it impossible to secure any other size required on special order; but that the

Reprinted from Mechanical Engineering, April, 1920.

general elimination of a great number of the sizes now in use and the consequent greatly increased production of the standard sizes could only tend to a reduction of mill costs and capital invested in manufacturers' equipment and in stocks in warehouses. Both of these sayings should have a lowering effect upon the price to the consumer and the problem was, therefore, truly one of conservation.

In the case of machinery shafting the users were equally unanimous in their approval of the plan to standardize sizes, but recommendations as to size interval varied greatly. However, these recommendations, in so far as they were definite and specific enough, were tabulated and a diagram constructed showing the relative popularity of the various size increments for each inch of diameter.

With these data accumulated and sifted down to usable form the committee felt that it was in a position to present its information and preliminary deductions to representatives of other interested organizations. Accordingly, invitations were issued to twelve societies and associations requesting them to consider the proposed lists of standard sizes and to appoint representatives to confer with the committee before its report was finally formulated. The seven organizations listed below responded and the standard sizes which follow have the unanimous approval of these representatives and, as far as can be learned, of their associations.

American Hardware Manufacturers' Association.

American Railway Engineering Association.

American Supply & Machinery Manufacturers' Association.

National Association of Manufacturers of the U. S. A.

National Association of Purchasing Agents.

National Machine Tool Builders' Association.

Southern Supply & Machinery Dealers' Association.

The committee then considered that it had completed the first part of the work to which it had been assigned, so on January 14 submitted to the council a progress report in which it recommended the approval and adoption of the following lists of sizes as standard for the society:

Transmission Shafting:

$\frac{1}{16}$ in.; $1\frac{3}{16}$ in.; $1\frac{7}{16}$ in.; $1\frac{11}{16}$ in.; $1\frac{15}{16}$ in.; $2\frac{3}{16}$ in.; $2\frac{7}{16}$ in.; $2\frac{11}{16}$ in.; $3\frac{7}{16}$ in.; $3\frac{11}{16}$ in.; $4\frac{7}{16}$ in.; $4\frac{11}{16}$ in.; $5\frac{7}{16}$ in.; and $5\frac{11}{16}$ in.

Machinery Shafting:

Size intervals extending to $2\frac{1}{2}$ in., by sixteenth inches; from $2\frac{1}{2}$ in. to 4 in., inclusive, by eighth inches; from 4 in. to 6 in., by quarter inches.

The council approved the report and accepted the recommendations.

In the opinion of the committee the adoption of standard sizes of shafting will mean that in the future there will be a gradual elimination of odd sizes from makers' lists and from dealers' stocks, and for new construction only standard sizes would be selected.

Before undertaking the standardization of the shafting formulae and the dimensions of shafting keys and keyways the committee plans to reorganize itself and add to its membership.

Casein

By HARRY C. BRADFORD

COW'S milk contains on an average about 3 per cent casein which exists in a suspended or colloidal condition, probably as a lime compound in combination with calcium phosphate, giving the milk its opaque appearance.

To Prepare Casein in a Laboratory

Separated milk is diluted to about five times its volume with water and sufficient acetic acid added to give 0.1 per cent of acid in the solution. The casein is precipitated, carrying down with it the fat. The curd is washed about ten times by decantation collected on a cloth filter, washed and pressed as dry as possible. It is then dissolved in the least quantity of ammonia and filtered. The filtrate is precipitated with acetic acid, washed and redissolved in ammonia. This process is repeated three or four times. The curd is then rubbed up in a mortar several times with 80 per cent alcohol and finally with absolute alcohol. It is next similarly treated with ether and extracted with ether in a Soxhlet apparatus and the casein finally dried at 100° C.

Preparation of Industrial Casein

The three methods generally used are:

(1) Precipitation by acid—usually sulphuric, although hydrochloric, lactic and acetic are sometimes used.

(2) Curdling by means of rennet.

(3) Curdling by self-souring.

Acid Precipitation. The milk is run into a large tank fitted with an agitator and the acid diluted with water and then added. When the curd is yellow and transparant, the agitation is stopped. The whey is run off and the curd washed with water, then pressed and dried.

Curdling with Rennet. The amount of rennet is first decided. This will depend on the acidity of milk and temperature.

The rennet is diluted with water and added to

milk of about 106° F., allowed to stand until it has set. It is then cut up and agitated and slowly heated up to about 120° F.

The whey is then run off and curd well washed with cold water, pressed and dried.

Curdling by Self-Souring. The separated milk is run into a tank. The temperature should be kept at about 98° F., which is the best temperature for bacilli to grow. After some hours the milk will be sour. Steam is turned on and the mass agitated in order to make casein.

The curd being firm and in a suitable condition for washing and pressing, the whey is run off and as much water as possible is pressed from the curd. The curd is then dried. The dry casein is then ground to a powder.

Alkali

The amount of alkali required to dissolve casein will depend on how the casein is made and the kind of alkali. For example, sulphuric casein will dissolve in about the following quantities, but there is most always more used in actual practice:

	Per Cent
Sodium carbonate	2¾
Trisodium phosphate	8
Ammonia	2½
Borax	9½

Rennet casein is insoluble in sodium carbonate, partly soluble in borax and ammonia, and soluble in trisodium phosphate and lime.

Testing Casein

To test casein for strength, a hand sample can be made to give a comparative test, but this will not give a practical test. If you would try to use the same proportion in the mill that you use in laboratory, you will find that you will not have the same strength, as the one in the laboratory will be much stronger.

To make a hand sample, use 70 grams casein, 1 gram diphosphate, 6 grams soda ash, 8 grams borax, and 2 cc. of ammonia. Add about 200 cc. of distilled water to casein and let it stand a few minutes. Add to the phosphate soda ash and borax about 100 grams distilled water; warm this to dissolve the alkali, then add to casein and make solution up to 350 grams. Place the dish containing the casein mixture on water bath having a temperature not to exceed 149° F. (65° C.) and stir until dissolved. One way to know when it dissolves is to watch the small paddle which you are stirring it with for undissolved casein. Take a little on the paddle and watch it carefully when it is running off. When the casein is about dissolved, add the ammonia, which will thin the casein. If you do not use the phosphate and ammonia, you will have a mixture which is thick, hard to cook, etc. Let the mixture cool to laboratory temperature and make solution up to 350 grams.

Seventy-five grams of china clay or kaolin previously dried at a temperature of 212° is weighed into a dish with 25 grams of satin white, which should be taken from a fresh barrel (be sure you get a good representative sample). Add also 150 grams of distilled water. Mix this solution up thoroughly so all the clay will be dissolved. After weighing the dish containing the clay and satin white, 30 grams of the casein solution representing 6 grams of casein is added to it and thoroughly mixed with the paste. A thin coating of the mixture is applied to several sheets (a good convenient size is 8½ x 11) by means of a brush about 2½ inches wide. Be sure to spread uniformly. After making the samples from the mixture, balance your dish on the scales and add 5 more grams of casein mixture. Make more samples and continue until you have added 70 grams or more of the casein mixture. It might be that you will have to begin by adding 20 grams to the clay and satin white, it will depend on the strength of the casein you are testing. It is best to keep a standard sample of casein to test new samples by. It is also much better to use clay and satin white than clay alone, as there is casein that will work satisfactorily with clay that will not with clay and satin white.

After making the samples before they are bone dry or nearly so, they should be run twice through a calender. It is best to run the coated side against the steel or chilled roll.

This makes your samples much more like a practical test than if they are not calendered.

There are two or three ways to test the samples. The thumb test is the one most used. It will not be necessary to state how this test is made as it is so well known.

Another good test is with the use of sealing wax. The sealing wax is softened by heating at one end and is applied with a little pressure to the coating; let it cool, and in removing wax the strong ones will pull paper, the weak ones just clay and satin white.

Casein can be tested for color, odor, fineness, moisture, fat, ash, nitrogen and acidity.

Color. You should keep a good standard casein nearly white or white to compare the new samples with.

Odor. The odor can be compared with the standard sample or can be determined by soaking 50 grams in about 50 cc. water and adding equal volumn of thick paste of "milk of lime." Let stand a few minutes and then compare the new sample with your standard.

Fineness. The more finely divided product is preferred as being easier to dissolve. This can be tested by using a screen.

Moisture. Weigh out say about 5 grams in an

(*Continued on page 464*)

Handling and Costing Raw Materials in the Manufacture of Paper

F. C. CLARK, M. M. KILEY AND H. R. HARRIGAN
American Writing Paper Company

Presented at the Joint Meeting of the Local Branches of the Cost Association and the Technical Association of the Pulp and Paper Industry on Monday Evening, January 19, 1920, at Holyoke, Mass.

The following is by M. M. Kiley, and is a treatise on the subject of handling old papers in the manufacture of paper. The handling of pulp will be treated in the next number.—Editor.

THE problem of handling and costing old papers is somewhat simpler than the handling of rag stock, because old papers are short-fibred stock. It is customary to weigh the bales and to sort old papers, making the following classified recoveries, namely, ground wood, sacking, wire and waste, each one of which is weighed separately and given a separate recovery value. The old papers are next dusted, and the dust is weighed if there is a considerable amount. In some lots of old papers, such as over-issue magazines, the dust is small enough so that it can be neglected.

The sorted old papers, freed of dust, are run over a scale and into the rotary. Where the mill practice is to fill the rotary by a conveyor, substitution of hopper-bottom cars for the conveyor will enable a weight of sorted stock to be taken without difficulty. The usual sorting-room department charge of applied cost covering overhead is applied to the net sorted magazines at this point of the process.

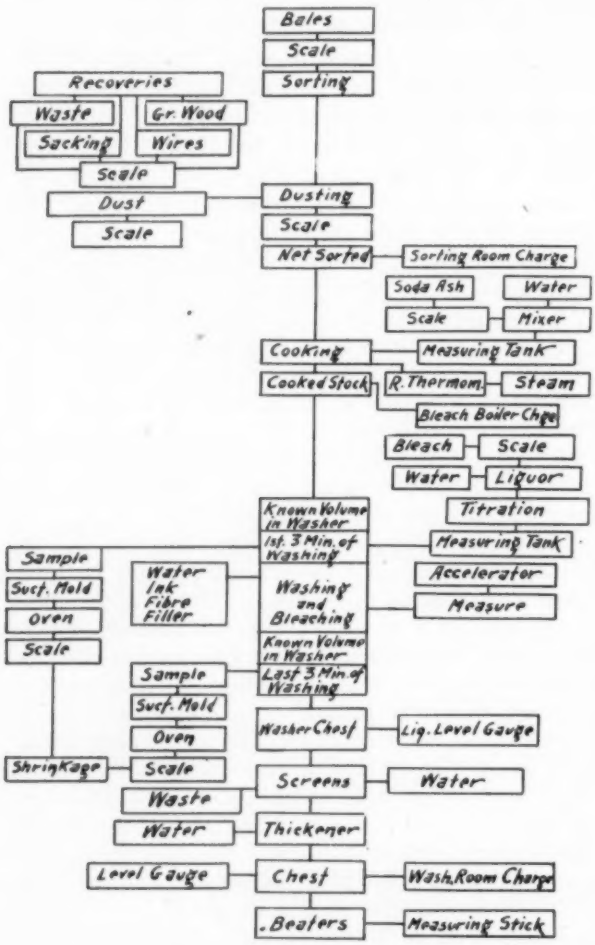
The stock is next cooked. When the sorted papers are furnished to the rotary to be cooked with soda ash, the soda ash is weighed dry, dissolved in a mixer tank with water, the solution run through a measuring tank until the entire charge of soda ash has been flushed into the cooker with a known volume of water. It has been found in practice that the addition of soda ash dissolved in a known volume of water gives better results than if the water and dry soda ash have been put in after the old papers have been furnished. Most of the mills regulate the cooking process by a steam indicating gauge which is often placed on the main steam line and serves to indicate the pressure in the main steam line rather than to give a true account of pressures inside the cooker. For this reason, a recording thermometer, so attached that it will record actual interior boiler conditions is recommended to control the cooking rather than the usual steam pressure gauge.

No allowance is made for shrinkage taking place in the cook. It is not evident from numerous tests that the loss in weight due to cooking has a value great enough to interfere with the accuracy if it is neglected in costing the process. Of course, cooking shrinkage may vary with the kind of stock furnished to the boiler, but where it is slight, and where samples of the cooked stock would be taken to determine the dry matter, in the entire cook from these aliquot samples, the weight of the dissolved chemicals deposited in the sample by the evaporation of the water from it, would partly compensate shrinking losses due to carrying away of dissolved materials in that part of the black liquor which drains from the stock. It is believed that further investigation will bear out the fact that a correction for the cooking shrinkage in the costing of old papers is not necessary. The bleach boiler department applied cost is attached at this point to take care of overhead.

In furnishing the washers from this boiler load, the dry fibre furnished to each washer may be accurately calculated by the net sorted weight determined in the sorting room, divided by the number of cars filled from the boiler and taken as a sum of the cars furnished to each washer. When it is understood that ordinary old papers, such as house-to-house canvas magazines, will carry as an average about 20 per cent of clay, filler, or other material that is not fibre, it is obvious that considerable shrinkage must be expected when this stock is washed. This shrinkage is commonly about .9 of the filler contained. For example, paper containing 20 per cent of filler when added to the washers may carry about 2 per cent in the half-stuff. A method has been devised for determining this shrinkage. Heretofore, the cost man has applied all his charges to the number of pounds of stock which was furnished to the cooker at the beginning of the process, and since there was a total shrinkage of at least 20 per cent during the process, it is evident that his cost figures per pound of stock must have been incorrect, because the costs were divided among a greater number of pounds than were actually obtained after the old papers had been through the entire treatment. The method for determining the washer shrinkage is as follows:

When the washer is furnished, it is filled to a point which has been previously determined, to mark a known capacity in that washer. This point could best be permanently set on the inside of the washer measuring down a definite distance from the top of the washer rather than up from the bottom for con-

venience. When the washer is accurately and evenly filled to the prescribed point, a sample is taken in a container, struck off flush with the top, and poured upon a suction mold equipped with a very fine wire, say of 120 meshes per inch. The water is drawn from it, the sample dried in the oven and weighed. Then the usual washing and bleaching process is carried on. The washer is continuously letting out water



which contains some ink, filler, and fibre which were part of the original furnish.

Titrating Bleach Liquor

When the stock has been sufficiently washed and is ready to bleach, bleach liquor is used which has been made by weighing the bleach from the drum, putting together a known quantity of bleach and water in an agitating tank, drawing off the bleach liquor and titrating it for strength, and adding it to the washer through a measuring tank. The titration method of testing bleach liquor is recommended every time instead of the usual test by hydrometer, for the reason that the hydrometer tells the quantity of dissolved substances in the liquor, but it gives no assurance that these dissolved substances are chlorine, and, since it is a measure of the chlorine in the liquor that is wanted, the titration is the only way to get it. This will work no hardship upon the mill, for a titration method for the strength of bleach liquor is being devised at our laboratories that will be simple enough so that it will compare favorably with the intelligent use of a hydrometer. If an accelerator is used with the bleach, it will probably be in such small quantities that an accurate cost account of it can be kept by adding it in known strength by a quart or gallon measure.

When the stock is sufficiently washed and bleached and is ready to be dropped from the washer, another sample is to be taken. Before taking the sample, the washer is filled to exactly the same height as when the washing was begun and the first sample taken. This second sample is to be taken with the same container, at exactly the same point in the washer, put through the same suction mold, into the same oven, and weighed as in the previous case.

The difference in weight between the first sample dried and the second sample dried is the basis for calculating the shrinkage which resulted from washing. Knowing the volume in the washer when the sample was taken, and knowing the density of the stock as determined from the sample, and also knowing how much was lost by washing it, the number of pounds of the original furnish lost while the stock was in the washer can be calculated. Washer volume x density per unit to start x percent loss=shrinkage.

It might be stated here that it is very necessary that care be taken in sampling the washer correctly. Within the first fifteen minutes of washing a large part of the filler washes out. For this reason the first sample should be taken not later than three minutes after the washer has been furnished and is mixing properly. In every case the sample should be a "struck" sample and the usual precautions that are necessary in making duplicate tests apply to the entire procedure. After the last sample has been taken the washed stock can be dropped to the chest. The dry content of each washer should be equal to the dry content of the last sample taken, multiplied by the number of times the volume of that sample is contained in the known volume of the washer when the sample was taken. When the washer is dropped to the chest, this figure can be checked.

If a liquid level gauge, properly calibrated, is set in the chest to read the depth to which the chest is filled in inches, and each inch is known to represent a definite volume, then the height to which the depth in the chest increased when this particular washer was dropped into it should tell us how much fibre went into the chest because we know the density of the stock. In order that there may be no doubt about this, each chest is equipped with a density regulator. It is said that these density regulators will keep stock within .3% of the density expected, and inquiries

(*Continued on page* 452)

Rubber Goods for the Paper Industry

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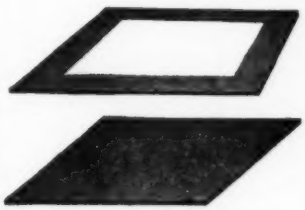

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UNITED STATES RUBBER COMPANY AND ASSOCIATED COMPANIES — US RUBBER SYSTEM

How Much Lubricant Does Engine Need?

By W. F. SCHAPHORST, M. E.

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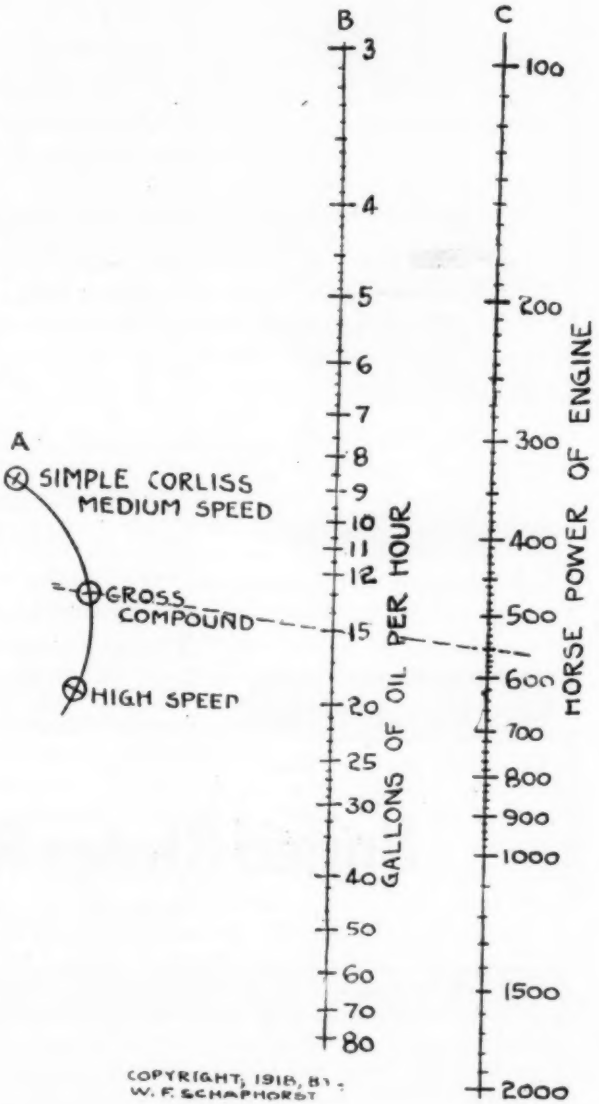
Sufficient lubrication without excess or stint is important. The author has, therefore, simplified a way to determine this. The other subjects treated on these pages are by the same author.—Editor.

HOW do you know whether or not you are feeding your engine bearings sufficient oil? In what way are you doing the oiling? Are you giving them a few drops at a time, every once in a while, and trusting to luck that there will be no hot box and that the friction horsepower will be maintained at approximately the most economically low point? Have you looked into the lubricating problem with much thoroughness?

The above questions are asked so bluntly because the chances are ten to one that you have been satisfied with the old method of lubricating. Most owners, superintendents, managers and engineers are. You haven't been made to feel that a change in your system is worth while. Much experimenting has been done in this important subject in recent years, and as a result automatic lubricating and filtering systems have been developed that are marvels of thoroughness in that they keep all bearings supplied with copious streams of oil at all times, reducing the necessity of keeping the bearings screwed up tight all the time. Looseness is no longer so much of a crime. The oil keeps the "cracks" filled up and the shaft and bearings operate on a thick film of oil without coming into actual metallic contact. Vibrations and shocks are muffled. The oiler doesn't have to climb around on a ladder and get into dangerous places. In fact, there is no oiler whatsoever; he is eliminated. Oil isn't constantly spilled on the floor because it is kept within pipes or in tanks where it cannot spatter. If any dirt or grit gets into the bearings, it is washed out by the rapid flow of oil, carried along with the oil, and finally filtered out. Money is saved because labor is dispensed with, repairs become less frequent, because of the power saving, the yearly coal bill is lessened and, due to the fact that the oil is used, filtered, used again, and so on, the yearly cost of oil is reduced to the very minimum. The quality of the oil does not appreciably change. Since one bearing may need considerably more oil than another, it is a simple matter to constantly feed the right amount to any given bearing, large or small, high speed or low speed.

So many experiments have been performed upon engines, and so much experience has been had with lubricating problems, it is pretty well known by this time how much oil any engine of a given size or speed demands for proper and thorough lubricating.

Based upon tables that are the outgrowth of innumerable tests of this sort, the writer has therefore developed a "handy chart" which tells at a glance the amount of oil needed for any ordinary Corliss engine of medium speed, any ordinary cross compound engine, or any ordinary high speed engine.



Simply lay a straight edge across the chart joining the kind of engine (curve marked "A") with the horse power of the engine (column "C") and the in-

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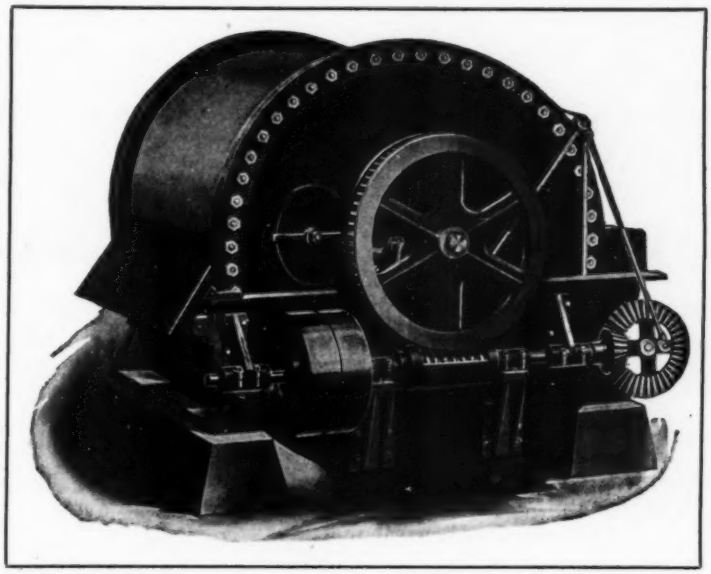

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J. F. DAVIS

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tersection with column "B" immediately gives the number of gallons of oil needed per hour.

For example: How many gallons are needed per hour by a 550-horse power cross compound engine? Connect the point corresponding with "cross compound" (curve marked "A") with the 550 (column "C") and the intersection with column "B" shows the answer as being 15 gallons per hour. The dotted line drawn across the chart shows how it is done.

A high speed engine of the same power will require about 17 gallons per hour, whereas a simple Corliss engine will need only 13 gallons per hour. The range of the chart is great enough to take care of most engines up to 2,000-horse power. Thus, a 2,000-horse power high speed engine would require a bit more than 50 gallons of oil per hour.

Is Lime a Belt Treatment?

A practice that should be discouraged among belt men is the usage of lime on oily belts. It is thought by some belt men that nothing is equal to lime for absorbing the oil and rendering the belt fit to do its work. Under oily conditions, however, almost any dry powder will make a belt pull better—anything that will absorb oil. A non-corrosive powder, however, should rather be used, such as chalk or fuller's earth. But, better still, don't use any powder at all. It harms, rather than benefits, a belt.

In emergencies, it is often considered good practice to "do anything in order to get out the work," but that does not imply that we should keep on doing it year after year. If oil continues to spatter on the belt, the belt man is bound to have more or less trouble right along, and he must keep on using this harmful expedient. Naturally, the belt won't last long under such severe conditions. The best treatment for an oily belt is to stop the oil spattering first and then keep the belt in good pliable condition. I know of no circumstances where oil throwing cannot be stopped. After that is done, I would wash the belt clean of the oil, and then fill it full of the best belt treatment obtainable. Do not use castor oil, neatsfoot oil, boiled linseed oil, etc. Use a treatment that is made specially for belts by a responsible manufacturer.

Handy Rule for Determining the Percentage of Belt Slip

I have been asked to give a simple but accurate rule for finding the percentage of belt slip.

Most rules as given in manufacturers' catalogs, text books, etc., are inaccurate because they do not take the thickness of the belt into account. The following is not given as being "perfect" but it will give results that may be used as reliable. All measurements should be in inches.

(1) Multiply the revolutions per minute of the driven pulley by the sum of its diameter and belt thickness and then by 100.

(2) Multiply the revolutions per minute of the driver pulley by the sum of its diameter and belt thickness.

(3) Divide (1) by (2) and subtract the quotient from 100. The difference is the per cent slip.

For example, a 10-inch driven pulley runs at a speed of 360 revolutions per minute. The belt thickness is 0.25 inch. The 20-inch driver pulley runs at a speed of 200 revolutions per minute. What is the percentage of belt slip?

Applying (1) we get 360 times 10.25 which is equal to 3,690. Then multiplying by 100 we get 369,000.

Applying (2) we get 200 times 20.25, or 4050.

Applying (3) we get $369{,}000 + 4050 = 91.2$.

Subtracting that from 100 we get 8.8 per cent slip.

Thrown into the form of an algebraic formula the rule becomes:

$$\text{Per cent slip} = 100 = \frac{100\ (d + t)\ n}{(D + t)\ N}$$

Where d = diameter of driven pulley, inches.
t = thickness of belt, inches.
n = speed of driven pulley in r. p. m.
D = diameter of driver pulley, inches.
N = speed of driver pulley in r. p. m.

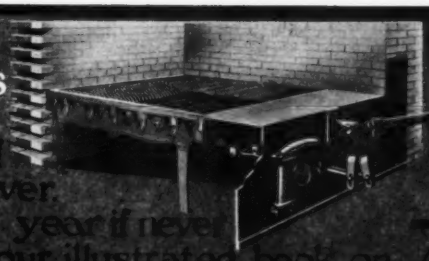
Packing Troubles

In talking to a chief engineer not long ago, I showed him a picture of a metallic packing which is giving very good service all over the United States, and Canada. A point in its favor is that it needn't be removed very often, if at all. An installation was inspected lately, for example, where a plunger equipped with this packing had been in operation for six years, operating against 160 pounds pressure, 212 degrees water, operating 12 hours per day, and the plunger was not so much as worn 1-1000 inch. The packing was still in perfect condition, and looked as though it should last 12 years more. The engineer in charge thought that the packing had saved him considerable time and labor and the owner considerable money. The chief engineer to whom I was talking, however, had his mind already made up, and was not open to conviction. He said, "I have tried metallic packing and will never try it again. It becomes a solid metallic mass, and if used in places that are accessible with difficulty, it cannot be removed easily enough. I have had to chip it out in several instances."

It is regrettable that such chiefs still exist. He is in charge of a large plant, and his mind should be open to new things. Improvements or attempts at improvements should be looked upon in an unbiased way, regardless of what experience may have

(*Continued on page 466*)

AJAX
Rocking Grates



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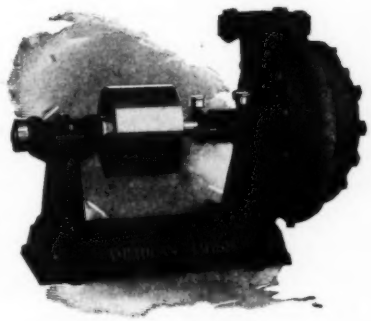

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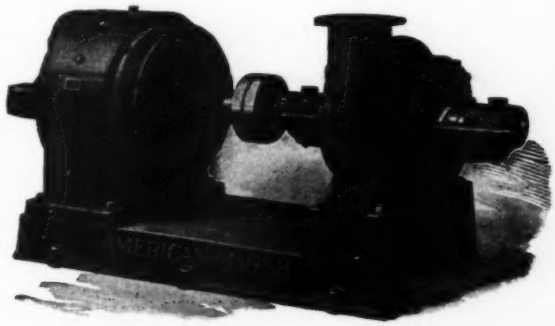

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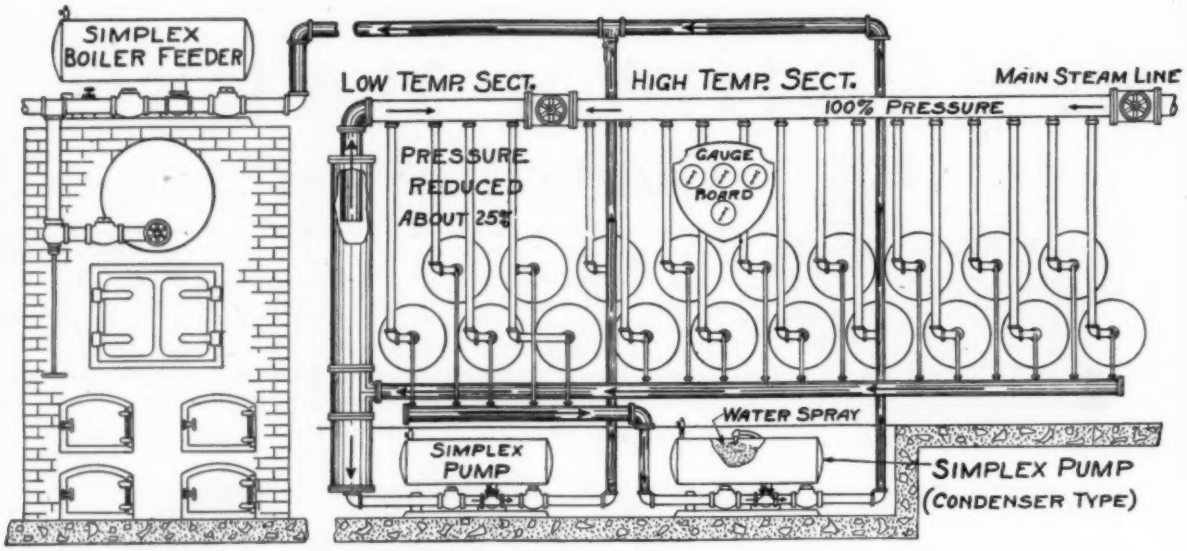
New Method for Heating Buildings

By F. C. FARNSWORTH

BUILDING superintendents and heating engineers will be interested in this new piping layout for a heating system which provides a Closed Loop circuit, whereby the water of condensation from the radiators is returned directly into the boiler. The radiators are kept free from air and water and the system will work satisfactorily on any pressure. That is to say, high, low or variable pressure and provides ideal heating conditions at all times.



This system is possible by reason of the chief features of the Duplex Boiler Feeder which permits a continuous flow of condensation into the boiler. The condensation is held under pressure and delivered into the boiler at a temperature only one or two degrees below the temperature of the steam, corresponding to the pressure carried on the heating system, and these results are obtained without the use of a Receiving Tank. There are no vents open to the atmosphere and practically no heat loss.

When the high pressure steam from the boiler is carried to the top of the building, steam passes through a reducing valve and then the risers drop from the main line to supply the various coils. The hangers supporting the coils are so arranged to give free expansion and contraction of the riser from the coil.

The return line of the coil is carried back into the riser with a drop of 9" before entering the riser with a check valve. By this static head of 9", all water between the check valve and the lowest pipe of the coil is sufficient to lift the check valve and permit the condensation to the coil to flow back into the same steam riser.

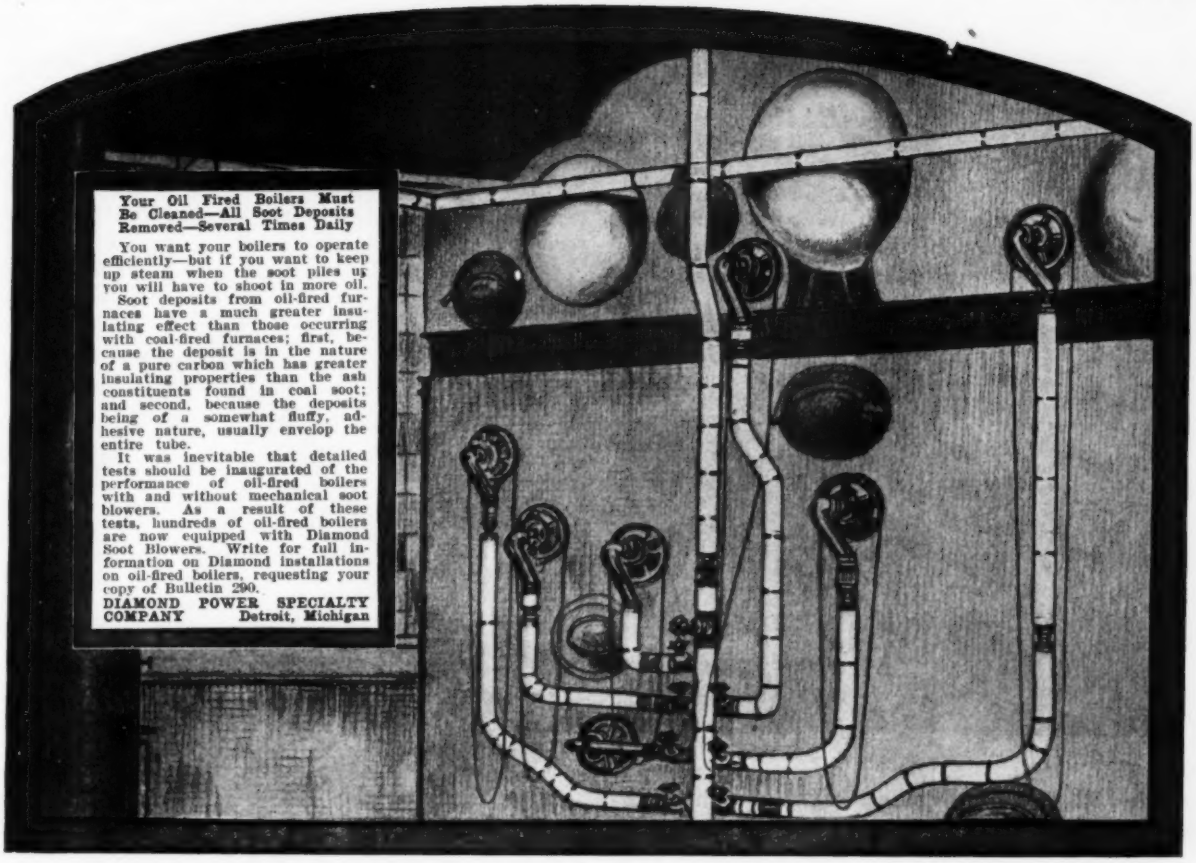
A full size pipe is carried from the return pipe of the coil to somewhere near the top of the coil where an automatic air valve is inserted. This full size pipe provides a sort of air chamber and eliminates the possibility of any water squirting out of the air valve which is so very often experienced where coils are used.

To make this job work properly, the proper distribution of steam supply pipes to the coils and the proper size of risers should be used. In other words, it is advisable to use about the same proportions in piping these coils as would be used on the common one pipe radiator or system.

The return pipe from all of the above risers is carried into a Boiler Feeder which is located somewhere above the water line of the boilers. This Boiler Feeder has two chambers; one chamber is always equalized with the return line receiving the condensation, while the opposite chamber is equalized with the boiler, delivering the water into the boiler. These chambers alternately fill and empty, which provides a continuous flow of water from the heating system directly into the boiler.

There are many advantages in this type of system. Less piping because no return lines are necessary other than to connect the risers to the Boiler Feeder. The Boiler Feeder will feed the condensa-

(Continued on page 466)



Your Oil Fired Boilers Must Be Cleaned—All Soot Deposits Removed—Several Times Daily

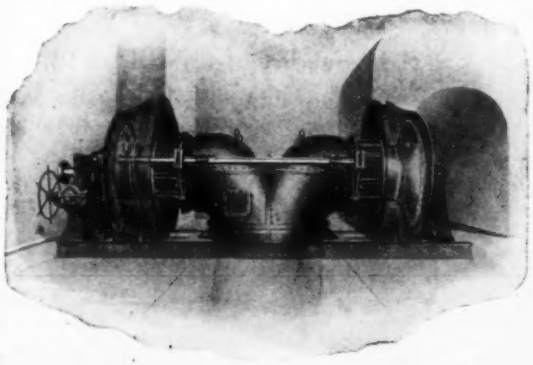
You want your boilers to operate efficiently—but if you want to keep up steam when the soot piles up you will have to shoot in more oil.

Soot deposits from oil-fired furnaces have a much greater insulating effect than those occurring with coal-fired furnaces; first, because the deposit is in the nature of a pure carbon which has greater insulating properties than the ash constituents found in coal soot; and second, because the deposits being of a somewhat fluffy, adhesive nature, usually envelop the entire tube.

It was inevitable that detailed tests should be inaugurated of the performance of oil-fired boilers with and without mechanical soot blowers. As a result of these tests, hundreds of oil-fired boilers are now equipped with Diamond Soot Blowers. Write for full information on Diamond installations on oil-fired boilers, requesting your copy of Bulletin 290.

DIAMOND POWER SPECIALTY COMPANY Detroit, Michigan

SMITH HYDRAULIC TURBINES



Accompanying view shows one of eight horizontal shaft "SMITH" Turbine units in successful operation in the Cornell Wood Products Co. mill at Cornell, Wis. Each unit develops 1550 H.P. under 37' 6" head.

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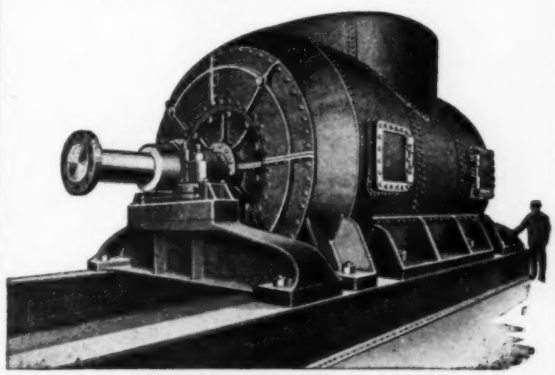

Large Horizontal Direct Connected Unit

Write for Bulletin 54

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A New Rapid and Economical Loader

By JOHN A. GOETZ

IN recent years the increasing use of sand, gravel, crushed stone, ashes, slag, etc., for road building, concrete work, and other purposes, as well as the increased storage of coal and coke, has caused

Figure 3

the handling and re-handling of immense quantities of loose materials.

During the time that help was plentiful and cheap, the prevailing method was to use a gang of laborers to shovel materials from ground storage to wagons or trucks. However, the constantly increasing cost and acute shortage of labor demanded the substitution of mechanical handling machinery to replace the

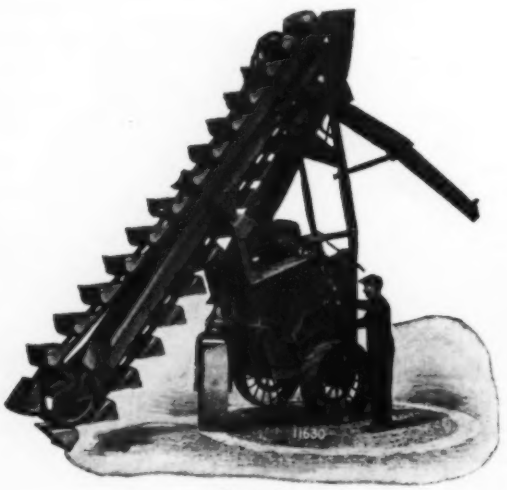

Figure 2

old expensive and laborious "hand shovel" method.

To meet this demand, a self-propelling loader was brought out about 10 years ago, after extensive experiments and tests and careful study of the then existing conditions, being the first machine of its kind to be placed on the market, and has proved a remarkable labor saver and quick handler of materials.

It has been used with great success by hundreds

Figure 1

of leading concerns, but in order to meet developments in the various industries and the constantly changing conditions, an improved design has been developed, which overcomes all the objections of the old type of machine, and is the last word in design and construction.

Self Feeding Into Pile

There is a great advantage in having the loader feed itself into the pile over other methods of hand

Figure 4

shoveling or using a special mechanical device to pull the materials in front of the buckets. The greatest objection to the old 4-wheel type of self-

(*Continued on page 462*)

Silicate of Soda

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A New Type of Beating Engine

By W. H. BURNS

IN beating stock there is a definite amount of power per ton necessary to hydrite it and prepare it for paper making use. To do this work efficiently, the power must be effectively transmitted to the stock, and an efficient beater therefore is one that will do this work in the shortest possible time, with the least expenditure of total power. The biggest factor in accomplishing this is to get as rapid a circulation as possible, for it is perfectly evident that if stock comes under the roll only ten times an hour, it will beat off much slower than if it comes under the roll one hundred times an hour.

With the idea in view of making this circulating speed as high as possible, the following important differences in design over the ordinary flat bottom beater have been introduced, with the result that not only has this been accomplished but other important advantages are found as described in the following paragraphs:

(1) The position of the lighter bar stand.

By placing this in the center, a shorter shaft is required than in the usual type. This makes for a much more rigid construction with the danger of springing a shaft practically eliminated, which feature is especially valuable when feeding in laps of frozen or dryer pulp. The main feature is that it makes it possible to raise the backfall and build up a higher head of stock, as the journal does not go through the back channel, thereby acting as a dam and retarding the flow. Also due to this design, a tub with a capacity of two thousand pounds, air dry, occupies much less floor space than a flat bottomed beater, which is a very important item in reducing construction costs. Two beaters, one a right-hand drive and one a left-hand, can be mounted almost back to back because of this construction with additional savings in floor space.

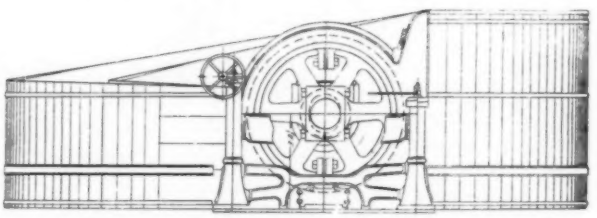
(2) The position and design of the doctors.

As seen from the drawing, the blade is placed so there is very little clearance between it and the fly bars and it is held there with springs. If a lap of pulp causes the roll to pump, the doctor jumps with the roll, but returns to its original position because of the tension exerted by the springs. The stock leaving the roll at its peripheral speed is almost thrown completely through the constricted openings between the doctor and the top of the back fall, practically none following the roll and causing the effect known as "churning." In any ordinary beater the stock carries over to a large extent, even though a doctor is used. The reason for this is that the usual position for a doctor is up on the hood, where it cannot possibly do much good, as it must be hung far enough from the fly bars to clear them when the roll jumps, and so ordinarily there is a great deal of clearance.

The constriction mentioned above between the doctor and the top of the backfall introduces the same principle underlying a centrifugal pump where the velocity head is changed to a static head in the pump casing.

(3) The backfall.

The double plane curve construction of the backfall also assists very materially in the rapid circulation of the stock, as it offers very little resistance to the flow. Due to this fact and also to the fact that there is a difference in head between the front and the back of the tub of about twenty-four inches, the stock flows very rapidly down the narrow outer channel to the roll. There are no dead spots which is most plainly seen where color is added to the beater. In two to three minutes the color is uniform throughout the pulp mass. This is especially helpful in matching new shades, and is proof of uniform beating treatment.



Another very important point which is due to this difference in head, is the fact that this beater dumps clean, with absolutely no raking down, in about 3½ minutes. This decreases the time that the beater is idle, very materially, and makes it much easier for the men.

Advantages

As proof of what these changes have accomplished, the following data is given. On an all sulphite furnish of Mitscherlich pulp, the charge being 2,180 lbs. air dry at 8.4% consistency, it was beaten in one hour, against 3½ to 4 hours in the usual beater. The rate of travel of the stock was sixty feet per minute or it passed the roll more than sixty times an hour. With the same furnish at 7.0% consistency, the rate of travel was very close to ninety-six feet per minute, and the stock came under the roll about one hundred time an hour. The power consumed was 150 H. P. hours, compared to 200 H. P. hours in the older type, a saving of 25%

(*Continued on page 468*)

THE DEAD CANNOT SPEAK —THE LIVING MUST ANSWER

The thousands killed in accidents each year cannot speak for themselves—they cannot prevent others from encountering the dangers which proved so costly to them. That responsibility is for the living.

The solution of this problem involves not only the saving of human lives but of millions of dollars—the annual cost of accidental deaths and injuries.

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Air Leaks

By W. F. SCHAPHORST, M. E.

On account of the great temperature variations in boiler settings, it is not always easy to keep the setting in a leakless condition. Brick settings are perhaps the worst offenders of all in permitting leaks, because they usually crack in time, and an enormous volume of air finds its way through to dilute the gases. Some makes of boilers require settings that are prone to cause more serious troubles along this line than others. The greater the surface surrounding the furnace, generally, the greater the danger of loss through air leaks. A low horizontal boiler, therefore, has its own particular advantages, but it must not be forgotten, at the same time, that a large combustion chamber is a prerequisite to thorough and complete combustion.

If there is a leak into the burned gases after they have left the heating surfaces of the boiler, no particular harm can result aside from the fact that such leaks will reduce the itensity of draft. It is, therefore, useless to take samples of gases from the chimney itself, especially if there are leaks through the base of the chimney or through the breeching. The proper place from which to draw samples is from the point of departure of the heating surface; in other words, from the place where the heating surface and gases "part company." The samples referred to are those taken for purpose of analysis. For example, if the leaks are of the nature described above the gases would have a smaller CO_2 content in the chimney then at the "leaving point."

Even where boilers are cased in steel or cast iron, air leakage is not uncommon. It is possible for the steel to warp, as every engineer knows. The warp causes a crack or space to form, and "there you are again." A good way in which to detect air leakage is to build a smoky fire and start it a-going nicely. Then, suddenly and completely, close the damper in the breeching and find the fissures through which the puffs of smoke are emitted. Close as many of the fissures or cracks as possible with plastic fire brick or other good material, and then try it again. In a short time, a smokeless setting will be the reward. Some engineers have found it profitable to cover the entire setting with a special paint, sheeting, or tarry preparation, for it is claimed, evidently with some truth, that air "seeps" through ordinary brick and its mortar joints.

It is possible to repair the inside as well as the outside of brick settings while in operation if it is found desirable to do so, as it often is. The fallen brick or crack opening may be filled with plastic fire brick applied from the end of the poker or slice bar. The patched job may not look very neat, but it will do temporarily. There are sound arguments in favor of using monolithic structure or lining from this plastic material, thus reducing the leak factor to the minimum. Durability and strength are other advantages of this kind of lining.

One of the prime essentials of efficient firing is the keeping of the furnace doors shut. The fireman should be taught to become skilled in the quick opening of the door, quick though careful discharging of the scoopful of coal, and the quick closing of the door. During every second that the furnace door is open a copious and costly quantity of unnecessary air is admitted.

Gas Masks in Pulp and Paper Mills

Gas masks of a nose-breathing type with canisters containing special chemicals are used in the digester house of the Forest Products Laboratory to give protection against sulphur dioxide. These masks enable the operator to make repairs under conditions otherwise unbearable and soon pay for themselves in time saved. Masks of this type are reported by the Bureau of Mines to hold up against a 5 per cent concentration of sulphur dioxide for about 15 minutes. When it is realized that 5 parts of sulphur dioxide to one million parts of air can readily be detected, and that at a concentration of 150 parts of sulphur dioxide to one million parts of air the air becomes unbreathable, some idea can be gained of the life of a canister even under adverse mill conditions.

In addition to their use in the sulphite mill, these masks are of great assistance in the bleach room, where they are worn continuously during the mixing of the bleach liquor. Aside from monetary con-

Modern Pulp and Paper Making

A Practical Book for Paper Makers

By G. S. WITHAM, SR.

The first practical book by an acknowledged authority on the manufacture of pulp and paper as it is carried on in America today.

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The properties of the principal woods and other raw materials used for paper.

The qualities, grades and requirements of all the different varieties of paper.

How a Fourdrinier machine is built and operated—in great detail.

What happens to the fibres in the beater.

How to make good ground wood economically.

How to cook sulphite pulp and make and reclaim acid.

The use of clay, size, alum, colors, etc.

How much power is required for every piece of equipment in a pulp and paper mill.

How to install a system of tests and records to keep production up to standard.

Actual complete specifications for Fourdrinier machines, beaters, Jordan engines, grinders.

All the newer developments in paper mill engineering and equipment such as suction couch and press rolls, individual electric drive for Fourdrinier machines, waste paper utilization, electric regulators for grinders, automatic dryer temperature control, weaving devices, Claflin engines, save-all installations, etc.

How to put on a new wire.

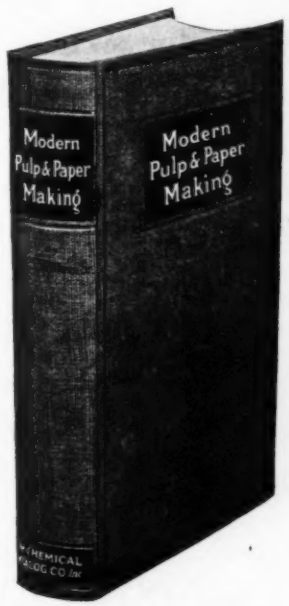
How to care for wet felts, dryer felts, deckles, etc.

How to start up a Fourdrinier machine.

How to install and operate a saw-mill.

How to detect the causes of breaks and defects and how to remedy them.

How to calculate the retention of clay, etc., etc.



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siderations, the increased comfort and safety of the workmen is sufficient argument in favor of the addition of gas masks to the regular mill equipment.

A Mechanical Overload Release

An effective "safety-first" mechanical device that will instantly disengage a drive when the load exceeds a predetermined point, has been recently developed. It is especially adaptable for elevating, conveying, and power transmission machinery.

It will automatically disengage the driving from the driven machinery if the load exceeds the fixed amount, thus allowing the driving power or other source of power to run free and prevent damage, due to the inertia of the motor armature or other high-speed moving parts.

The construction of this device is such that it will release whether the load is gradually or suddenly applied, but it can be set so that it will not trip from jars or shocks.

It is symmetrical, and can be assembled to operate in either direction. It can be adjusted for tension, so that it will operate for any desired overload. The mechanism is entirely inclosed and can be packed with grease for lubrication purposes.

Handling and Costing Raw Materials

(*Continued from page* 438)

about their operation have been very encouraging.

From the washer chest, the stock goes to the screens where it is diluted with water so that the fibre can be separated from the dirt. The stock is moved about the mill by a pumping system, which is kept continuously in circulation and has an additional advantage over the old system of trucking in cars that is not often apperciated; namely, the continuous circulation of the stock at from 5 to 7% density has an action upon the fibre somewhat similar to a mild beating action caused by the friction while in motion, and some paper-makers say that this circulation serves to take the place of some of the time they would have to keep the stock in the beater under conditions where the stock is moved in cars. It should be understood that the slush or pumping system for distributing old paper stock is given preference over all others.

To go back to the screens where the dirt is separated from the fibre, the weight of the discarded material is small and would have been such a small ratio to a cook of five tons that it can be neglected or, if desired, figured for several cooks, an average taken and added in all cooks to the shrinkage determined from the two samples taken from the washer.

The next step in the process is to get out most of the water that had to be added to make the stock thin enough to go through the screens. Thickeners are used to do this, and all the stock is pumped to the

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thickener. It then goes to the chest, from which the beaters are furnished. It is assumed that only water leaves the stock at the thickeners. The thickener discharges into a chest equipped with a liquid level gauge and a density regulator. By means of these two instruments, the contents of the chest can at any time be known accurately by determining the weight of dry fibre as controlled by the density regulator and the volume filled in the chest, as indicated by the liquid level gauge.

An Example

Now the stock is ready to be furnished to the beater. Suppose we take a concrete example. It has been found in some mills that the easiest way to transfer from the old system of cars to a new pumping system was to take the formulae of furnishes which the mill had been accustomed to using, and to supply a table which would give each car in the old furnish a new value in terms of inches of old paper stock pumped to the beater. In one case that comes to mind, it was found that the dry fibre in a car of old papers, as taken from the drainers before the pumping system was installed, was equal to 7 inches in the beater for the first car, and 6 inches for every following car as supplied by the pumping system. So, for furnishing two cars of magazine stock, the beater helpers were instructed to fill the beater 13 inches deep with slushed old paper stock before any other parts of the furnish were put into the beater. Here some care is necessary, because slushed stock of 6 or 7% consistency is sufficiently viscous so that it will meaure deeper near the inlet from the pumping system than in other parts of the beater. Since the beaters are usually calibrated by filling them from a tank of known volume, such as a portable size tank, using water as the liquid, it can be seen that it is necessary to keep the surface of the stock which is being measured as level as the water which was used to calibrate this beater in the first instance. Some paddling of the stock may have to be done where only a small amount of old papers are furnished to a beater, and if accurate results are wanted, it is necessary to have an even distribution over the entire beater when measuring the depth, if water was used for the original calibration.

The liquid level gauge in the chest is a very valuable check, for, since the thickener will deliver to this chest at a practically constant rate, when the beater is furnished from the chest the fall in level in the chest, plus the thickener delivery during that time, will represent the amount of this stock sent to the beater. The ratio of inches in the beater to inches in the chest can be easily found and used to determine, by means of the liquid level gauge, whether the man who has furnished the beater has filled it to the proper depth going by his measuring stick. For, if the inches in the beater prescribed are not followed

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as carefully as they should be, the liquid level gauge will show it on its record.

Summary

The stock is purchased in bales; these are weighed on a platform; they are sorted and recoveries are weighed out into classified lots which are charged up on their own particular value according to whether they are ground wood, wire, or other recoveries. The dust is removed and weighed and the net sorted papers are weighed. The sum of the net sorted papers, dust, and recoveries should equal the original bale weight. The only cost figures taken on the cooking process are for the process materials and department charges. The cook is divided into a definite number of cars, the dry weight of each car being the weight of net sorted papers divided by the number of cars, and each washer furnish being the number of cars in the washer multiplied by this average dry content. The yield from the washer is taken as the known volume of the washer, multiplied by the density per unit volume when the washer was dropped to the chest. These figures, plus the calculated shrinkages, should equal the net sorted stock, when the sum of all the washers is taken. The yield calculated from the density samples taken the first and last three minutes of washing must check with washer yield as calculated from the chest. The delivery from the chest to the beaters in terms of inches in the beater, plus the shrinkage calculated at the washers, should check the net sorted stock at the beginning of the process. It has been frequently true that the total charges for the treatment of old papers have been applied to a number of pounds of material which were furnished to the boiler as net sorted stock at the beginning, while, as a matter of fact, the costs are to be applied to the actual number of pounds produced, which, on account of the shrinkage taking place in the washers will be only about ¾ of the sorted material which was furnished to the cooker. It is expected that this procedure and the instruments mentioned will make reliable figures for the entire process of treating old papers available.

Questions

Mr. Bush: I woud like to ask if the density regulator and liquid level gauge will really work.

Mr. Kiley: I cannot say definitely about the actual performance of a density regulator. There is no difficulty with the liquid level gauge. The density may vary according to the amount of water that is used to flush down the chest. A table could be used so that the amount of water could be brought to a certain depth. The principle of the density regulator looks all right. I have every reason to believe that it will work.

Mr. Balch: It occurs to me that, if the density regulator and liquid level gauge are absolutely accurate, there is a lot of unnecessary testing done all along

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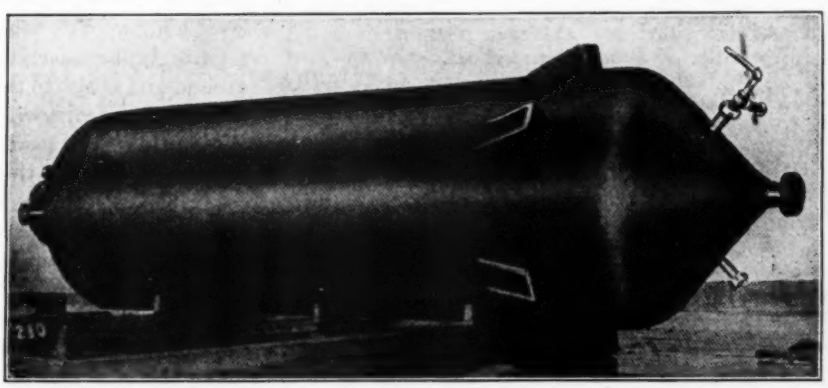

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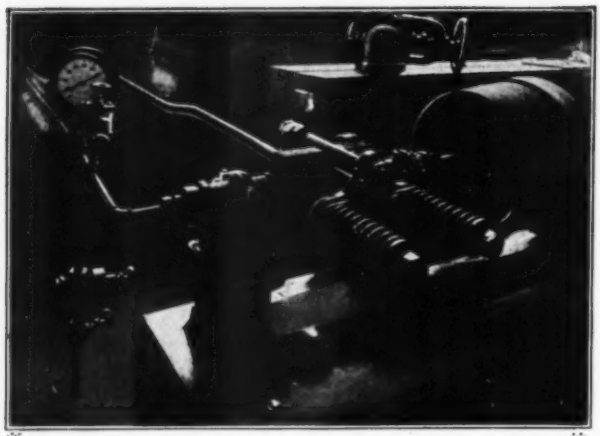

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NEENAH, WIS.

the line. What's the use of taking all the other checks along the line if you can get an accurate figure at the end? It seems to me that we are duplicating a lot of work there.

Mr. Kiley: There are checks provided all through this process. The gauges alone are sufficient to give the final results that are necessary, but it is believed that for particular results at least one check should be used. A new system, such as this one would be in most mills, cannot be recommended for use unless some check is kept on its early performance. Not only do the washer samples provide this basis of checking the contents of the chests, but the dried sample serves to show the superintendent how carefully the washing and bleaching has been done, and also serves to show by this particular shrinkage at this point how different grades of old papers, such as crumpled stock or over-issues, can be expected to act in the washer, and a corresponding comparison of their costs and their actual value thereby determined. For the laboratory determinations of ash or kind of fibre, the second sample taken from the washer can be used.

Mr. Hutchinson: Eventually you might skip the two washer tests and go to the last one in the chests.

Mr. Kiley: It might eventually be possible to take the reading from the density regulator and liquid level gauge alone, giving the figures in the chest due to the drop of your washers. You might be able to get yield by multiplying the density per unit of volume by the volume in the chest, and taking the total volume of stock in the chest produced from the cook as the yield of that particular boiler. To do so would be to accept unchecked records for actual shrinkage, and the washer test is considered of sufficient value to be worth keeping.

Mr. Tucker: I would like to ask Mr. Kiley if he plans to use an agitator in his chest with the liquid level gauge. You will have to calibrate your gauge separately, because your agitator will move the stock around and is apt to throw it to one side. If the gauge is not calibrated, it will record a smaller amount where the stock is low in the chest and a larger amount where it is high in the chest.

Mr. Kiley: We are used to calibrating all sorts of things. We think we could fix that up all right.

Mr. Clark: There is not going to be any method by which you can put in a lot of apparatus and expect it to work accurately. Your gauge will have to be calibrated to work with the chest. It must be calibrated for the particular thing it is to be used with.

Mr. J. Johnson: I believe from experience that the liquid level recorder is a very good thing. You can regulate the stuff when it goes down into the beater, and in that way figure what it is going to hold. The liquid level recorder keeps the stuff uniform.

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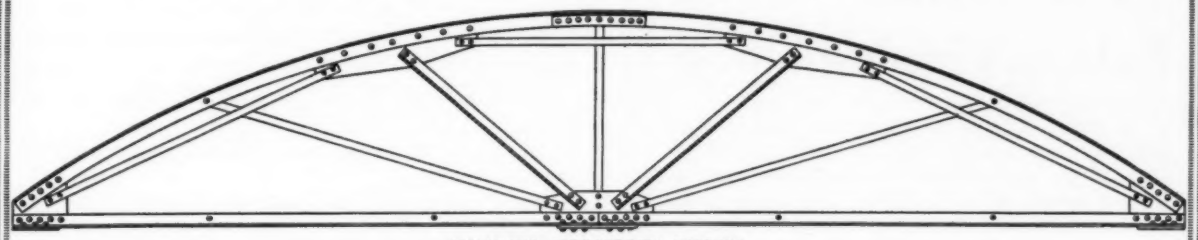

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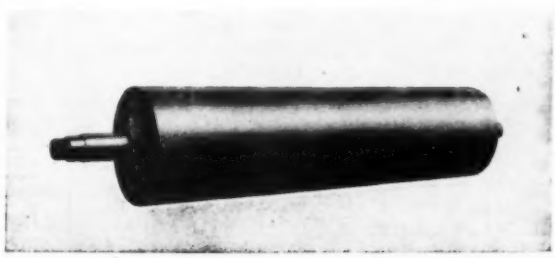

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(*Continued from page 433*)

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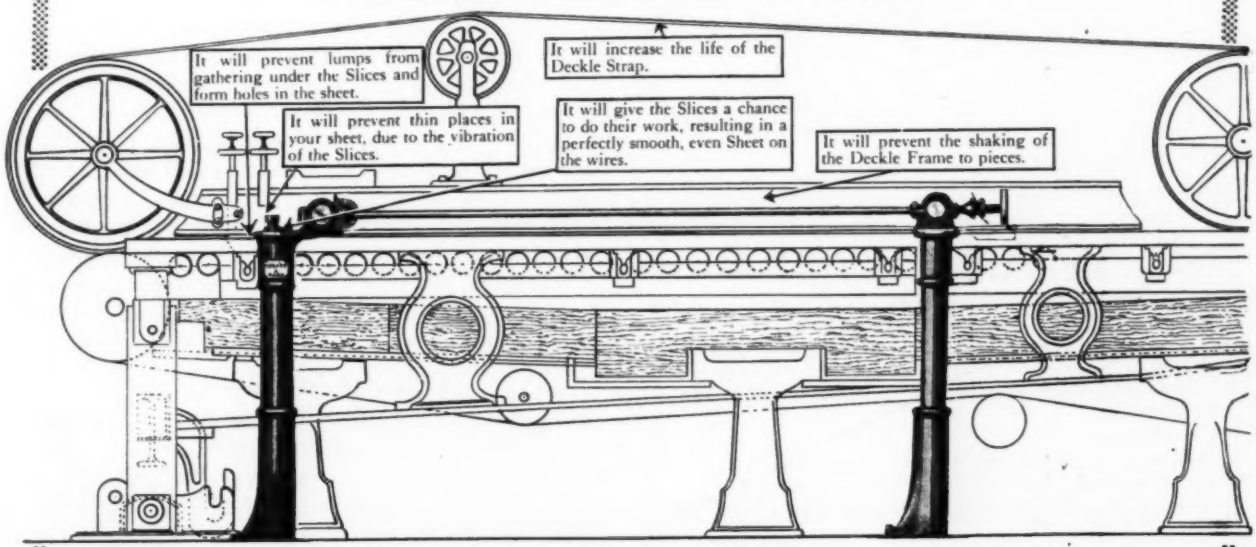
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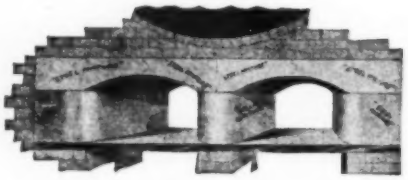

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A New Rapid Loader

(*Continued from page* 446)

propelling loader was its inability to feed into the pile.

Three Wheel Construction

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Figure 5

pile by swinging alternately upon its driving wheels as pivots, which action is obtained through the use in its driving unit of a set of differential gears, the same as in an automobile, whereby the driving wheels act in conjunction with or independently of each other.

As noted in Fig. 1 and Fig. 3 by turning the steering wheel at quite an acute angle to the driving wheels, the discharge chute will remain practically stationary at the center of the circle while the pick-up end of the extending elevator boom will travel in a circular path or by alternately reversing the propelling drive, the loader will oscillate back and forth in an arc. If the steering wheel is gradually turned through a few degrees either way from the above circular path, the whole machine, while cutting from right to left in an arc will gradually move forward into the pile, allowing full range of the machine. These illustrations also show the small radius in which the loader will operate.

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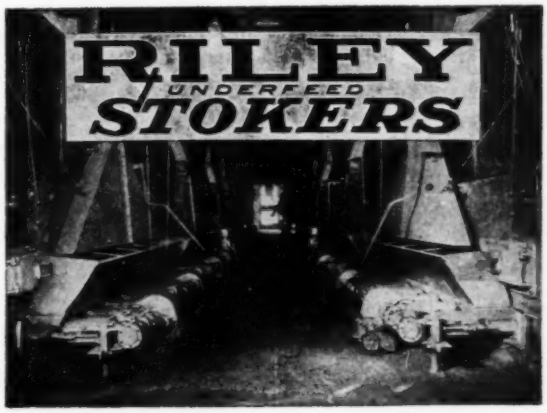

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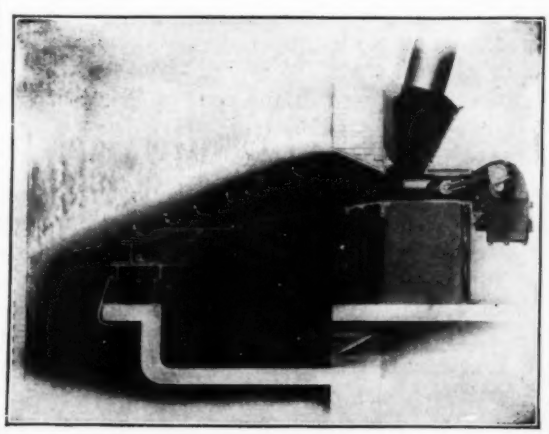

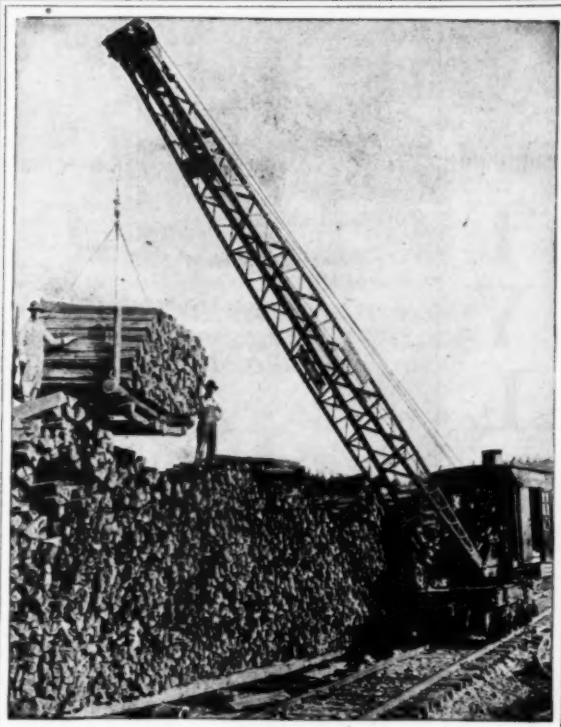

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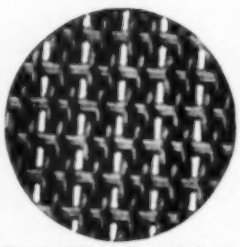

Triple Warp Fourdrinier Wire, Magnified Section

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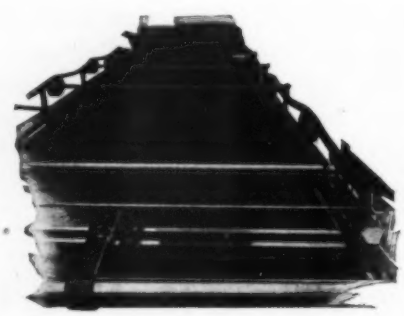
The Tyler Triple Warp Fourdrinier Wires are made from phosphor bronze wire and are used for making finer grades of light weight paper, such as carbon, cigarette, high grade tissue, India and Bible papers, and other specialties.

As illustrated above, these wires are woven with a triple warp and a single shoot wire.

The triple warp wires can be woven to fit any paper-making machine, but are generally used on the smaller machines.

Prompt deliveries can be made on all meshes of Tyler Fourdrinier, Cylinder and Washer Wires. In many instances shipment can be made from stock, including the Tyler Special Wires and the regular No. 60, 65, 70, 75 and 80 Wires.



The W. S. Tyler Company
Cleveland, Ohio

Manufacturers of Fourdrinier Wires, Cylinder Faces, Washer Wires, Corduroy Cloth, Backing Wires

their operation, and all controlling levers are in plain sight and in easy reach of the operator.

Fig. 3 shows the loader handling material from storage pile to railroad car. The perfect swiveling chute makes it convenient to distribute material over a large area without moving the loader. Loading direct from Hopper Bottom Car into motor truck is illustrated in Fig. 4. An extra man has been placed in car to feed material through the hopper doors. In Fig. 5, the loader is shown handling coal from a pile under a trestle.

Casein

(*Continued from page* 436)

evaporating dish and dry at about 212° F. or 100° C. for about six hours. The dish is cooled in a desiccator and weighed.

Fat. It can be determined by extraction with ether in a Soxhlet.

Ash. Weigh out about 3 grams and carefully charr over the low flame of a Bunsen burner, then burn to a white ash in an electric muffle furnace; cool in a desiccator and weigh.

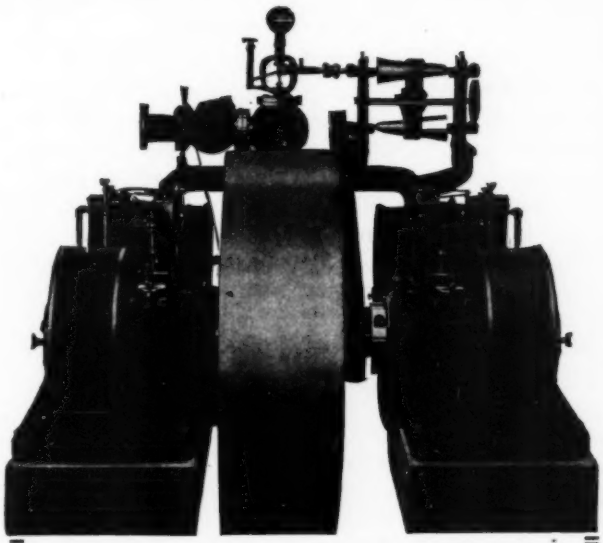
Natural-sour caseins should not contain more than 3 per cent ash; acid casein, 4.5 per cent, and rennet casein, not more than 8.5 per cent.

Nitrogen. This can be determined by Kjeldahl test, or as follows, which is used by the U. S. Forest Products Laboratory, Madison, Wisconsin:

A 0.5-gram sample is weighed out into an 800 cc. Kjeldahl flash; 20 cc. of concentrated sulphuric acid, 10 grams of crystallized sodium sulphate, and a small crystal of copper sulphate are added, and the contents digested until a clear solution is obtained, and then for 30 minutes longer. Then, 300 cc. of distilled water, 50cc. of a 1.1 solution of sodium hydroxide and about a quarter of a gram of granulated zinc are added, and about 250 cc. distilled over into standard sulphuric or hydrochloric acid (30 cc. or N/5 acid will be sufficient). The excess acid is back-titrated with standard sodium hydro-oxide solution, methyl red or cochineal being used as indicator. Nitrogen is reported on the moisture, fat and ash-free basis. It should not be less than 14.25 per cent.

Acidity. Weigh out 10 grams and add 20 cc. of distilled water; shake up and pour off and test with litmus paper or methyl orange.

Henry Lindenmeyr & Sons, among the largest paper merchants in New York City, heretofore conducted as a partnership, have incorporated under New York State laws with an authorized capital stock of $1,600,000. The following officers have been elected: President, Gustave Lindenmeyr; Vice Presidents, Walter H. Stuart and Joseph H. McCormick; Secretary, Kenneth C. Kirtland, and Treasurer and General Manager, Fritz Lindenmeyr. These five officers comprise the Board of Directors.



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solves the problem of your variable speed drive. Its reliability results in maximum production. That's why ***one in every three of these engines is a repeat order.***

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SEND US YOUR OLD GAUGES

We can make them better than new—prompt delivery guaranteed—uniform quality at a satisfactory cost

We Pay Express Charges Both Ways

The men employed by us are experts in this line. We have the capacity and equipment to handle a large amount of this work. Give us a trial.

Write for particulars of Our New Hydraulic Gauge. Eliminates spring troubles and stops Vibration.

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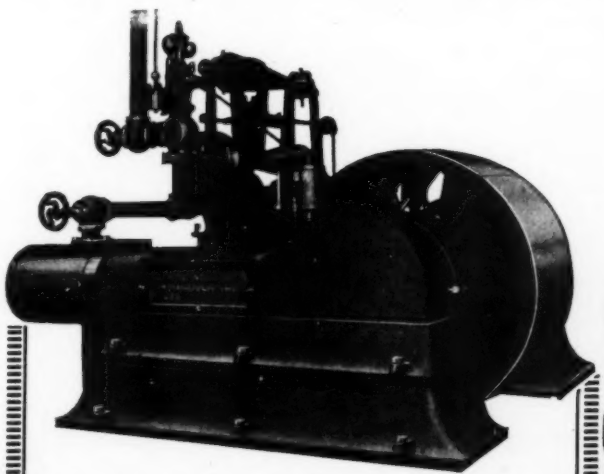
Inquirers Please Mention THE PAPER INDUSTRY



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Paper Mill Economy is assisted very materially by the installation of High Grade Variable Speed and Constant Speed Engines.

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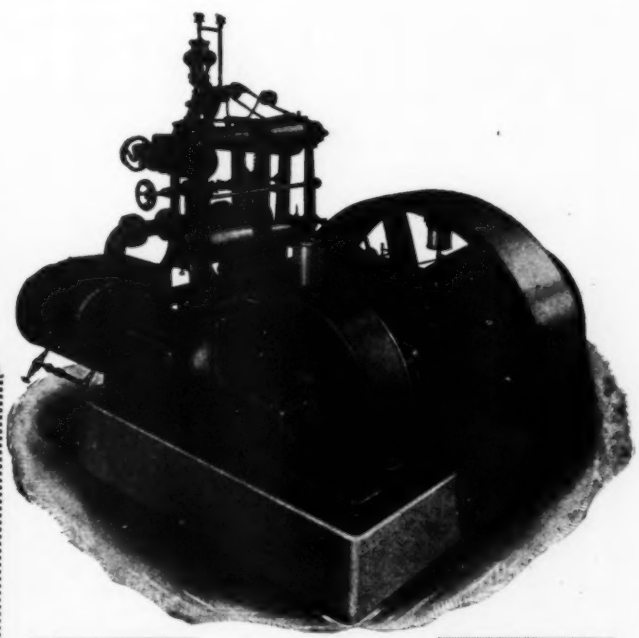

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The engine illustrated above is especially designed to drive paper machines, giving continuous and reliable service. A patented safety device protects your employees and plant.

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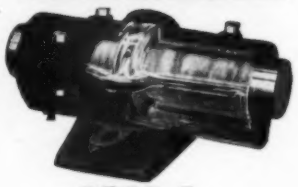

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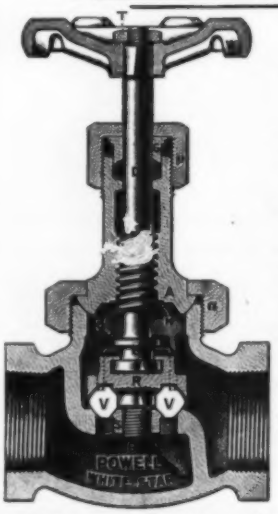

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THE WM. POWELL CO.
DEPENDABLE ENGINEERING SPECIALTIES.
Established in 1846
CINCINNATI, O.

Packing Troubles

(*Continued from page 442*)

taught with other equipment made of the same material. If all engineers had thrown up their hands after the first failure we would not have progressed very far in the manufacturing world by this time. With any packing, whether it be fabric or metallic, there are some cases where inaccessibility in design of stuffing boxes makes the packing very hard to remove. And the engineer's statements with reference to the metallic packing is true to the extent that it is more difficult to remove than the fabric, but it is the claim of this manufacturer that his packing needn't be removed. In other words, if you get the right packing, you can leave it in, and removal troubles are eliminated. In case it is necessary to remove such metallic packing as are made of babbitt foil, spirally wound, it is not very difficult to screw into the packing itself with packing hooks made for the purpose, and pull the packing out. With separate individual rings, which do not amalgamate with the other rings because of the laminated construction and lubricant between every sheet, the removal operation is performed with still greater ease.

So, all in all, the writer is convinced that the above chief engineer is considerably in the wrong. His case is analogous to the engineer who declared he would never install another centrifugal pump because he "tried one once" and it wouldn't pump enough water. The pump he had was all right for its capacity, but what the engineer needed was a larger capacity pump. However, the engineer couldn't "see it that way" because he had been prejudiced against "new fangled equipment" from the start, and was determined to go back to the old form of reciprocating pump, which was a steam waster, but he could speed it up when he wanted to pump a greater volume of water in a given time.

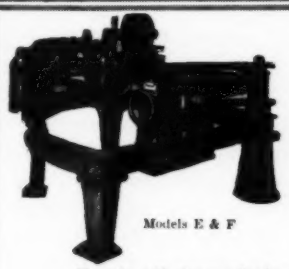
New Method for Heating Buildings

(*Continued from page 444*)

tion into the boiler at the same temperature that it leaves the system. In other words, the condensation is held under a pressure and fed directly into the boiler.

For illustration, if one pound is carried on the system, the water would be fed into the boiler at 212 degrees; if 5 lbs. was carried on the system, it would be about 225 degrees; if 10 lbs., about 240; if 50 lbs., about 300; and so on up. This type of system will circulate freely on atmospheric pressure or any pressure that may be desired.

This coil system is in use in some of the largest factories for heating purposes in this country. To have a perfect job, it is only necessary to carry out the proper size pipe, give the pipes the proper pitch



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The jet of high velocity steam carries the ashes away instantly. The conveyor cuts handling from hours to minutes. Saves 50 to 75%. Send for catalogue P, that describes this conveyor.

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SINCE the days of 1875, Davis Valve Specialties have been giving the dependable service that makes lasting friends. Representative of the entire Davis line of "steam savers," all of which have an application in paper mills, is the Davis Regulator. It has no delicate parts requiring attention and adjustment—is built like a pair of balanced scales. And its action is just as visible, accurate and unerring. Write to the

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In order to "make good" day after day in paper manufacturing a lubricant must be able to "stand up" under excessive bearing pressure and resist the heat transmitted by steam as well.

Extensive use of Keystone Grease in large paper mills throughout the country conclusively proves it to be unparalleled for the lubrication of both calender and finishing rolls of any character, particularly where unusual heat conditions exist.

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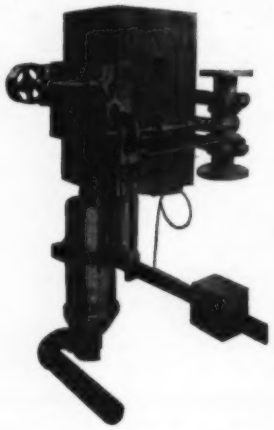

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REGULATORS that REALLY REGULATE. which will cause stock to be delivered to beaters, mixers or paper machines at a uniform consistency. Something long sought in the paper industry.

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and set the coils level. The Boiler Feeder will feed the condensation into the front of the boiler or the rear, or feed it in both ways. There is an advantage in feeding the water into the boilers both ways, because if just a little water is going in through the blow off connection, it prevents the possibility of the blow off connection closing up with sediment.

The writer in his travels noticed in a number of the big plants that a small feed line is carried into the blow off so that a small portion of the water is going into the blow off connections, and it is claimed that they keep the blow off lines free.

Hundreds of large plants are feeding all of the water into boilers through the blow off connections as a great many engineers believe that this is the best place to feed water into boilers, especially with this Closed Loop Boiler Feeding System which feeds water into the boiler very slowly and easily.

A New Beating Engine

(*Continued from page* 448)

in power and doing the work in one-quarter of the time.

On a book furnish where the work is mostly breaking up the pulp and broke, the stock being Jordanned quite severely, the usual time in this beater for filling, beating and dumping is not more than twenty minutes, compared to sixty minutes in the old type. The consistency is about 8½% air dry, and the rate of travel about eighty feet per minute. The power required in the new beater is about 20-25 H. P. hours, compared to 50 H. P. hours in the old, a 50% saving, and doing the work in one-third of the time.

In beating a charge of No. 1 new overall cuttings, 1,600 lbs. air dry at a consistency of 6.5%, the time required was two hours and fifty minutes, compared to 8-9½ hours in the old type of beater, at an estimated savings in power of from 15-20%, and one-third of the time. The power saving is estimated because the older type beaters were driven from a line shaft run by water wheels, and the exact power used is not known.

To sum up the advantages of this beater there are:

(1) Shortened beating time. One beater does the work of two and sometimes of three beaters.

(2) Lessened power costs. The power is more effectively transmitted to the stock with a saving of from 15-50%.

(3) Saving in floor space. A congested beater room can be relieved, or additional equipment installed without enlarging the beater room. This has actually been accomplished in two Wisconsin mills recently, the saving in one case being the entire elimination of a new seventy-five thousand dollar building.

(4) Smaller initial investment. The housing of the smaller installation lowers the construction

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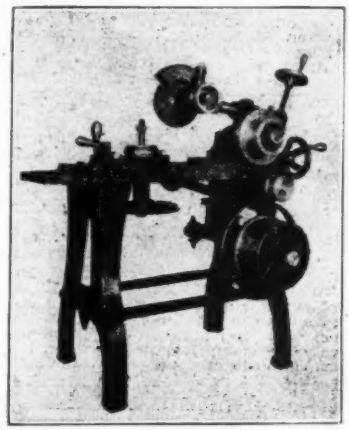
Costs less to do it yourself and you get better work and more of it if you use only sharp cutters.



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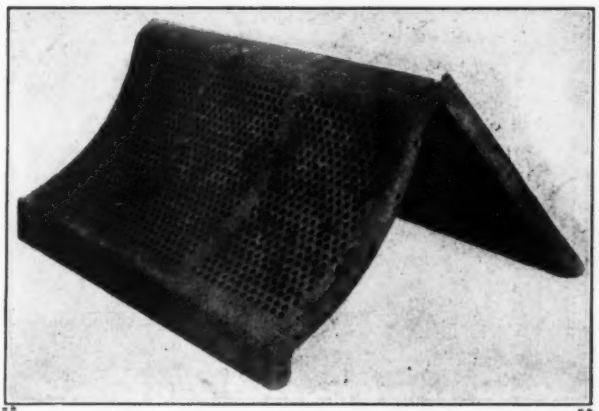

Because there are no moving parts this is a very simple but very efficient device. Patent No. 1,271,426 issued to Mr. Brownell Buehler, July 2nd, 1918.

The Shartle Continuous Beater Company

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Jenssen Two-Tower Acid System

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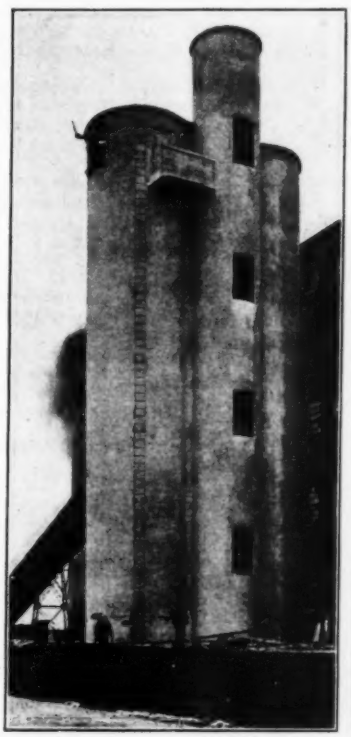
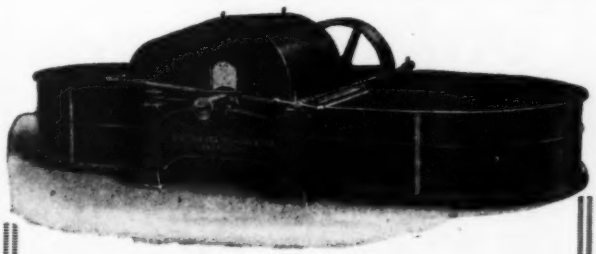


Jenssen Acid Towers at Great Northern Paper Co. Mill at Millinocket, Maine



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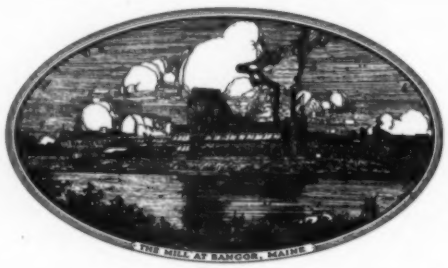
Dayton Beater and Hoist Co.

DAYTON, OHIO



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Vegetable Parchment Company
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"World's Model Paper Mill"
Makers of vegetable parchment and waxed paper

costs, and as fewer machines will do the same work, the saving in investment for both beaters and power equipment necessary to drive them is very large.

(5) Lower labor costs. Because of the fewer machines, fewer men are needed.

(6) Uniform quality of beating. Because of the thorough mixing of the stock and the elimination of all dead spots.

Superintendents' Convention

(*Continued from page* 406)

H. R. Lewis, Hollingsworth & Vose Company, East Walpole, Mass.
Herbert Lippitt, Brown Company, Portland, Me.
John Lowe, Appleton Coated Paper Company, Appleton, Wis.
Paul D. Luce, Boston Woven Hose & Rubber Company, Syracuse, N. Y.
Arthur M. Phillips, R. J. Dowd Knife Works, Beloit, Wis.
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A. F. McFarlane, Green Bay Paper and Fibre Company, Green Bay, Wis.
L. U. McIntyre, McIntyre Board Company, Fayetteville, N. Y.
E. R. MacLaren, Albany, N. Y.
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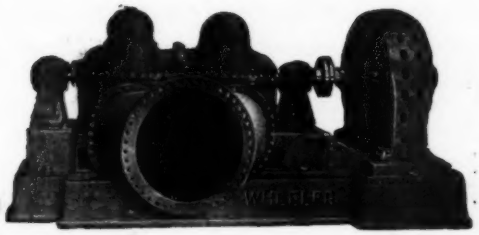
Timothy H. Neville, Beaver Board Company, Buffalo, N. Y.
N. J. Niks, Kalamazoo, Vegetable Parch Company, Kalamazoo, Mich.
R. A. North, Green Bay, Wis.
Martin Nolan, Diana Paper Company, Harrisville, N. Y.
D. F. O'Connell, Northern Paper Mills, Green Bay, Wis.
C. O. Thorne, Watervliet Paper Company, Watervliet, Mich.
John H. O'Connell, King Paper Company, Kalamazoo, Mich.
L. D. Post, New York.
C. A. Poland, Wm. A. Cole Paper Company, Putney, Vt.
W. E. Packard, Hammermill Paper Company, Erie, Pa.
J. E. Power, Jr., U. S. Rubber Company, New York.
Jacob Parent, Western Board and Paper Company, Kalamazoo, Mich.
George H. Pountain, Monarch Paper Company, Kalamazoo, Mich.
P. B. Johnson, Hewitt Rubber Company, Buffalo, N. Y.
Jas. A. Quigley, John W. Higman Co., New York.
G. E. Rausch, Pittston Paper Corporation, Pittston, Pa.
M. Redmond, Kalamazoo Paper Company, Kalamazoo, Mich.
C. F. Redmond, Kalamazoo Paper Company, Kalamazoo, Mich.
Henry C. Reimer, Kuttroff-Pickhardt & Co., Chicago.
H. W. Reynolds, R. and J. Dick, Ltd., Chicago.
H. W. Severn, Miami Paper Company, West Carrollton, O.
W. T. Schenk, Champion Coated Paper Company, Hamilton, Ohio.
E. W. Sharpless, Menasha Printing and Carton Company, Menasha, Wis.
Chas. W. Shartle, the Shartle Brothers Machine Company, Middletown, Ohio.
Edw. Shields, Green Bay Paper and Fibre Company, Green Bay, Wis.
Edward Simonson, Buffalo, N. Y.



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Why?

Because we study carefully the local conditions of your plant and design the Wheeler centrifugal pump to meet those conditions most economically. This means we recommend a suitable pattern, the necessary speed, and the type of drive,—motor, engine, belt or rope—which will give the correct mechanical operation. And our recommendations are backed by 23 years' experience in designing centrifugal pumps ranging in capacity from 20 to 100,000 gallons per minute and for any commercial head.

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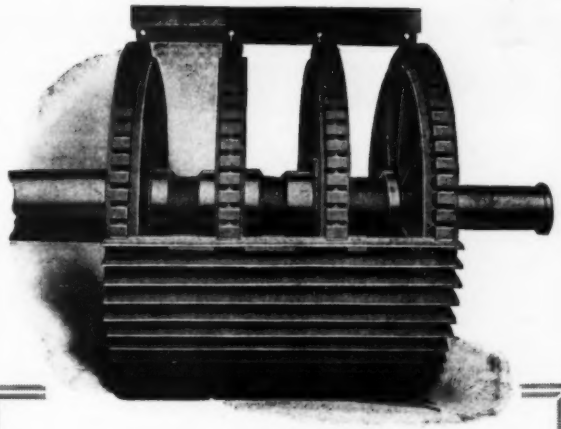
No. 92



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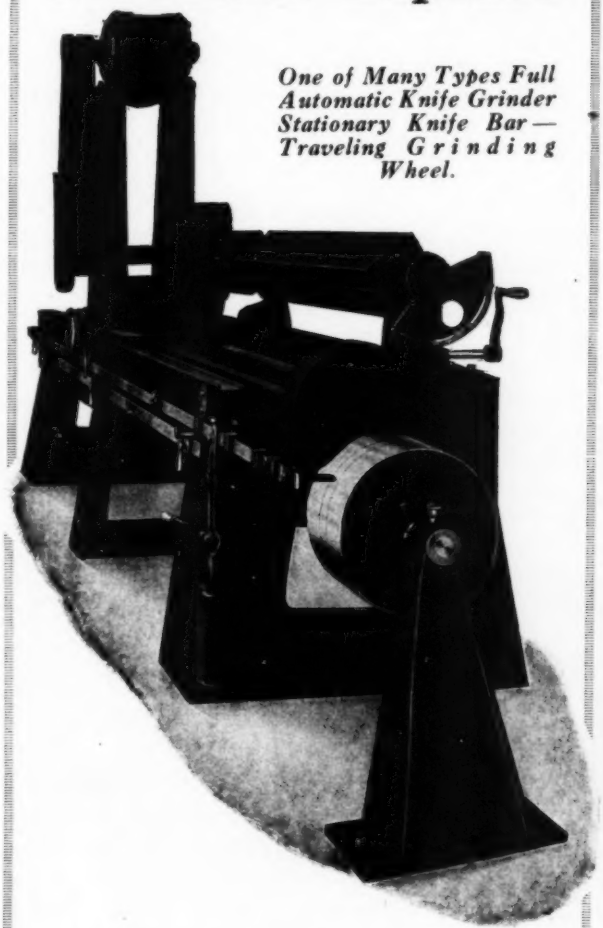
C. E. Stevens, Arrowhead Mills, Fulton, N. Y.
H. E. Stafford, Knowlton Brothers, Watertown, N. Y.
C. D. Townsend, United States Rubber Company, Springfield, Mass.
S. W. Tripp, M. E. Avery Company, Watertown, N. Y.
Frank O. Tuchscherer, the Calco Chemical Co., Chicago.
N. Ulrich, Wolverine Paper Company, Otsego, Minn.
H. C. Ulrich, Mumford Paper Mills Company, Mumford, N. Y.
J. R. Van Amber, North Counties Coal and Supply Company, Watertown, N. Y.
L. R. Verdon, Western Paper Mills Supply Company, Kalamazoo, Mich.
C. W. Whitehouse, Abitibi Power and Paper Company, Iroquois Falls, Ont.
S. Walker, U. S. Rubber Company, Boston, Mass.
Thos. F. Woods, West End Paper Company, Carthage, N. Y.
M. M. Whitman, Marathon Paper Company, Rothschilds, Wis.
F. A. Whittiger, Kuttroff, Pickhardt & Co., Inc., Chicago.
Edward Wright, High Falls Pulp and Paper Company, Chateaugay, N. Y.
W. H. Wightman, Lee Paper Company, Vicksburg, Mich.
A. G. Wightman, Hawthorne Paper Company, Kalamazoo, Mich.
E. H. Williams, Williams Gray Company, Chicago.
A. F. Wilcox, United States Rubber Company, Chicago.
John F. Yordy, Howard Paper Company, Urbana, Ohio.
W. C. Ziemann, Abitibi Power and Paper Company, Iroquois Falls, Ont.
Charles Wayte, Skinner Engine Company, Erie, Pa.
John D. Watson, Wisconsin Wire Works, Appleton, Wis.
Charles E. Raney, Mid-West Box Company, Kokomo, Ind.
Edward J. Buell, Niagara Wire Weaving Company, Ltd., Niagara Falls, Canada.
L. S. Sterrett, United Paperboard Company, Lockport, N. Y.
Wm. H. Lee, Lockport Felt Company, Newfane, N. Y.
E. E. Johnson, International Paper Company, Niagara Falls, N. Y.
H. E. Moore, the Mitchell Continuous Beater Attachment, New York.
Fred J. Rooney, the Upson Company, Lockport, N. Y.
William H. Brydges, Defiance Paper Company, Niagara Falls, N. Y.
John J. Turnbach, Beaver Board Company, Thorold, Ont.
Wm. H. Theroux, Sandusky Foundry and Machinery Company, Sandusky, Ohio.
Fred Payne, River Raisen Company, Monroe, Mich.
James T. Castle, Hooven, Owens, Rentschler Company, Pittsburgh, Pa.
Mr. McDermott, Mr. Davis, Mr. Law and Mr. Pennwell, Beaver Board Company, Buffalo, N. Y.
H. Lindsay, Lindsay Wire Weaving Company, Cleveland, O.
H. P. Bliss, Monroe, Mich.
W. F. Hazel, Warrensburg, N. Y.
W. A. Yule, F. C. Huyck & Sons, Albany, N. Y.
Wm. F. Jackson, Niagara Falls, N. Y.
R. C. Mead, Detroit, Mich.
W. C. Armstrong, Detroit, Mich.
J. S. Stewart, Chicago.

Forestry Conference

At the behest of the Forest Products Laboratory, Madison, Wis., the National Council of Furniture Associations has called a meeting of all organizations of manufacturers using wood to be held at Madison on July 23, 1920, immediately following the Forest Products Laboratory Decennial Celebration. The purpose of this conference is to consider the establishment of a national forestry policy which will insure an adequate supply of wood and will stabilize the industries dependent upon our forests for their raw materials.

BETTER Knife Grinding at Minimum Expense



One of Many Types Full Automatic Knife Grinder Stationary Knife Bar — Traveling Grinding Wheel.

IN these days of high costs, a comparatively low priced machine of strictest accuracy, of simple construction, but full automatic in every respect, and of heavy, rigid build, insuring long service, offers real economy in keeping all knives from 6-inch to 190-inch, up to highest cutting efficiency. We make all types of grinders for every variety of service in fitting knives, saws, shear blades, etc.

Write for Catalog and commendations on your requirements.

Machinery Co. of America

Big Rapids, Michigan, U. S. A.

Branch: Seattle, Wash.

The Mountain Goes to Mohamet

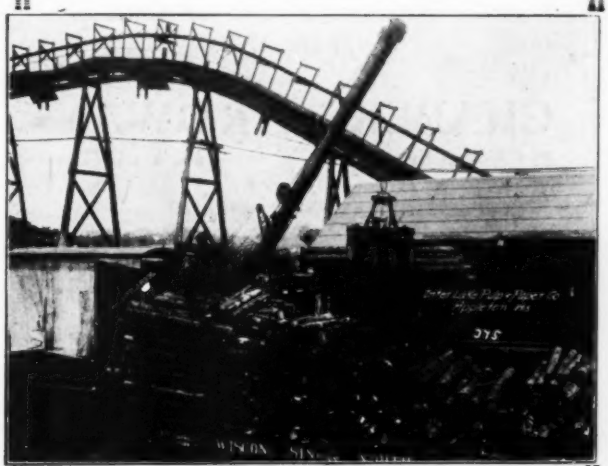
¶ If you wish to unload pulpwood directly onto your woodpile—

¶ A carload of coal directly into your coal bins—

¶ Remove the accumulated rubbish in and about your wood yard—

¶ Handle any new machinery from the flat cars—

¶ Dig the excavation for any new addition to your plant—



BYERS' Auto Crane

will go right to the job. You do not have to bring the job to it.

Runs like an automobile, using gasoline, steam or electricity for motive power and does all your sling, clamshell, grab, orange-peel or magnet work equally well. It will do all your regular loading, unloading or lifting work at a saving of many dollars in time and labor, paying for itself in a very short time. *Write for Bulletin No. 1016.*

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311 Sycamore Street, Ravenna, Ohio

The YARYAN EVAPORATOR

As engineer for the Yaryan Co. I installed, in 1886, the first Yaryan Evaporator placed in a soda pulp mill for the recovery of soda.

The Yaryan Evaporator is familiar to all soda pulp manufacturers.

Many important improvements have recently been made, but the principle has been retained.

It is the ideal evaporator for Soda and Sulphate Mills

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SUCCESSOR TO
THE YARYAN COMPANY

We Can Still Offer

A 20-Ton and a 50-Ton Board Mill, also Two 6-Ton Bogus, Straw or Tissue Mills, 10-Ton Felt, Corrugated or Sheathing Mill, 10-Ton Tissue Mill, also Three Fibre, Binders' or Leather Board Mills, 4-Ton, 5-Ton or 8-Ton production, Textile and Colored Specialty Mill, 6-Ton production. We also can offer re-built Pusey & Jones 68-in. trim Board Machine. Delivery September. Exceptional opportunity.

Gibbs-Brower Co.
Paper and Pulp Mill Brokers
No. 261 Broadway, New York City
Telephone: Barclay 8020

OUR MOTTO: "Service First."

Kalamazoo Cost Meeting

A meeting and banquet of the Kalamazoo Valley Local Division of the Cost Association of Paper Industry was held at the Park American Hotel May 24th.

Dr. C. Oliver Wellington of the firm of Scoville Wellington and Company of Boston, Mass., gave an excellent address on "How Paper Mill Executives Use a Complete Cost System."

Mr. Henry E. Surface, United States Valuation Engineer, explained his questionnaire.

There was an attendance of about sixty. All of the mills of Kalamazoo were represented, also the mills of Otsego, Plainwell, Watervliet, Three River, White Pigeon and Vicksburg. A larger percentage of executives were present at this meeting than there had ever been before.

Mid-West Salesmen's Meeting

A meeting of the Pulp and Paper Mill Salesmen's Association of the Mid-West will be held at the Hotel La Salle, Chicago, June 29, in Room 1811, at 4 p. m. The Committee of Arrangements is composed of:

J. L. Fearing, Chairman, International Paper Co.
Geo. H. Fay, G. H. Mead Co.
Frank A. Borchers, Menasha Paper Co.
J. R. Russell, Marathon Paper Mills Co.
F. D. Wilson, Chicago Coated Paper Co.
Dinner at 6:00. $2.50 a plate.

Practical Book for Paper Makers

A new book entitled Modern Pulp and Paper Making, by G. S. Whitham, Sr., Manager of Mills, Union Bag and Paper Corporation, is being published by The Chemical Catalog Company, Inc., New York City. It is the first practical book by an acknowledged authority on the manufacture of pulp and paper as it is carried on in America today. Being a modern, practical treatise on every phase of paper-making from the saw mill to the finishing room, the book is one for which the paper industry has long been looking.

The book contains about 500 pages, size 6x9 and is divided into twenty chapters. It is profusely illustrated from photos and drawings and bound in genuine buckram.

Not only is the book intended for men engaged in pulp and paper manufacture, but the needs of all who are associated with the industry in any way have been constantly kept in mind.

The St. Regis Paper Company, of Watertown, N. Y., is planning to establish a branch pulp producing plant in the vicinity of Oscalana, Quebec. The plant is estimated to cost approximately $50,000.

Mill Agents and Dealers

All Grades of Paper and Board

Agents for The Riverton Paper Company, Inc., Riverton, Conn. Manufacturers of light weight specialties.

Ground Wood and Chemical Pulp

STATE PULP & PAPER COMANY, Inc.
8 West 40th Street, New York City

Ticonderoga Machine Works

TICONDEROGA, N. Y., U. S. A.

MANUFACTURERS OF

WARREN IMPROVED CALENDER DOCTORS
With Flexible Blades, Universal Adjustment and Control (PATENTED)

WARREN IMPROVED PATENT DOUBLE DRUM WINDERS

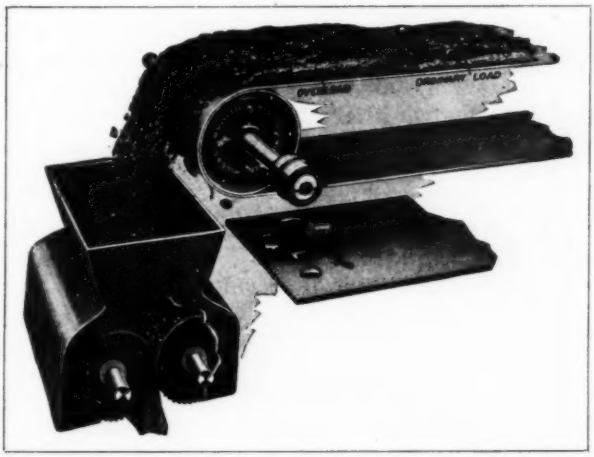
Patent BALL VALVE Hydrant
Stock Circulating Systems *and*
other Paper Mill Specialties

SEND FOR OUR BULLETIN

MAGNETIC PULLEYS

"HIGH DUTY"

Are the only positive safeguard to prevent Nails, Pins, Pieces of Broken Machinery, etc., from getting into your stock



All paper stock should be run over one of our Magnetic Separators before going to the dusters. This would remove everything in the shape of metal, and thereby prevent these pieces from going into the stock, which cause considerable trouble, and ruined wires or felts.

Let us tell you more about the advantages of using one of these machines

Magnetic Mfg. Co.
766 Windlake Ave., Milwaukee, Wis.

Foreign and Domestic

PATENTS AND TRADEMARKS
PATENT LITIGATION

Infringements, Titles, Searches. WE SPECIALIZE IN PATENTS RELATING TO THE PAPER MAKING INDUSTRY. All members of our firm are Law School graduates and have had more than 10 years' Patent experience.

Black, Oleson, Allen and Thorne

Patent Attorneys

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Do You Know That

Claflin Continuous Beaters

Have 3½ times the efficiency of other beaters in use today for Beating, Brushing and Refining Paper Stack?

For Increased Production, Greater Economy, Stronger, Finer, More Uniform Pulp, the CLAFLIN CONTINUOUS BEATERS will more than satisfy.

Ask Us for Our New Catalogue

THE CLAFLIN ENGINEERING COMPANY
LANCASTER, OHIO

The Canadian Fairbanks-Morse Company, Limited Agents for Dominion of Canada.

Change of Name

The Fibre-Board and Pulp Products Drying Machine Corporation, Hudson Terminal Building, 50 Church Street, New York City, announces the change of its corporate name and it will hereafter be known as the H. P. Coe Drying Machine Corporation of the same address.

The new name is distinctive of the inventor of the original Multiple Deck Roller Drying Machine, as originally used for various other purposes, with highly satisfactory results. With years of experience in manufacturing and installing drying machines of the roller type, he remains at the head of the present organization.

SIGNODE SYSTEM

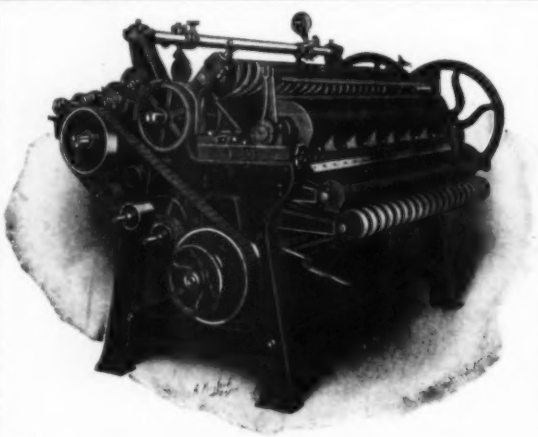
Framed Reams, strapped with Signode System

Signode straps insure delivery of framed paper bundles in the same condition they leave the mill. Cheaper than rope. No battered corners. Liberal trial arrangement.

Write for Particulars and Prices

The Signode System, Inc.

564 W. Adams Street CHICAGO, ILL.



PAPER CUTTERS

Single, Duplex, and Diagonal

CUTTER KNIVES

PATENT TOP SLITTERS

Hamblet Machine Co.

LAWRENCE, MASS.

English China Clays Form New York Sales Corporation

English China Clays, Ltd., of St. Austell, England, owners and producers of over 500,000 tons of English China clay per annum, announce that they have completed arrangements whereby the consumers of English clays in America are placed in direct connection with the producers in England—by the formation of the English China Clays Sales Corporation of New York, for the purpose of conducting through them all their sales and service business.

The sales corporation will have a capital of $500,000, $250,000 of which will be paid in cash at once, the balance when necessary.

The officers will be—

Mr. Sigmund Goldman, president.

Mr. Hilliard M. Gillespie, vice-president.

Mr. Arthur H. Holbrook, secretary.

Mr. Goldman has for the past fifteen years been associated with and in charge of the clay department of Perkins-Goodwin Co., sole agents for the West of England and Great Beam Clay Company, Ltd.

Mr. Gillespie is of Messrs. Hammill & Gillespie, for more than sixty years agents for Martin Bros. Ltd., producers of the famous Lee Moor clays.

Mr. Holbrook was associated for twenty-seven years with John Richardson Company of Boston.

The sales corporation will also have as treasurer a prominent man from the St. Austell office who is thoroughly familiar with the production of clay and shipping conditions in England.

The new organization will enable the consumer to obtain his requirements of clay more regularly and satisfactorily.

It is intended to have the new sales corporation commence business July 1, 1920, and announcement will be made later of office location.

Vocational Education Fund

Contributions to the fund being raised by the Vocational Education Committee of the Technical Association of the Pulp and Paper Industry are as follows. This fund is being applied for the preparation of a course in papermaking intended for the employees of pulp and paper mills.

Previously acknowledged	$19,695.27
Berkshire Hills Paper Company, Adams, Mass.	50.00
Brown Company, Portland, Me.	100.00
Detroit Sulphite Pulp and Paper Co., Detroit, Mich.	200.00
Neenah Paper Company, Neenah, Wis.	50.00
Nekoosa-Edwards Paper Co., Port Edwards, Wis.	100.00
Watab Pulp and Paper Company, Sartell, Minn.	100.00
Total to June 4	$20,295.27

The admission to membership in the Technical Association of the Pulp and Paper Industry of five active members, two associate, twenty-four corporate and one junior member during the first week of June is a good indication of how this highly beneficial organization is making rapid progress.

The Logic of Co-operation

WE believe the greatest and most satisfactory results as individuals or as an institution come thru co-operation.

That load moves easier with a team, providing the team pulls together.

We are always glad to co-operate with the purchasing department, engineer or owner on evaporator installations. That the load moves is very evident from the repeat orders that have followed from our oldest customers—our catalog contains a list.

Swenson Evaporator Co.

Main Office—945 Monadnock Block, Chicago
Eastern Office—318 Widener Building, Philadelphia

Have You Tried Cotton Linters for Paper Stock?

It Will Pay You to Figure With Us

Our organization covers the South

Steele By-Products Co., Inc.

DEALERS IN
Cotton—Linters—Waste

GENERAL OFFICES AND WAREHOUSES
BIRMINGHAM, ALABAMA

305-6 Slaughter Bldg. **DALLAS, TEX.**
1013 Hearst Bldg., **CHICAGO, ILL.**

Mills Dealers

Get This Information for Your Sales Dept.

The Second Annual
Revised and Enlarged
1920 Edition
of the

Directory and Buyers' Guide
of the
Paper Box and Allied Industries
Is Now Ready

Containing 290 Pages
The Most Reliable List Ever Compiled of
Corrugated & Solid Fibre Container Manufacturers
Ice Cream & Oyster Pail Manufacturers
Fibre Can & Tube Manufacturers
Paper Can & Tube Manufacturers
Folding Box Manufacturers
Set-Up Box Manufacturers
Private Box Plants

Price: Three Dollars

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Fourdrinier Wires
Cylinder and Washer Wires

Belleville, New Jersey
U. S. A.

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Valves, Unions, Cocks, Fittings, Digester Parts, Castings, etc., for Sulphite Mills from Our Perfection Bronze

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PAPER STOCK, COTTON AND WOOLEN RAGS.

395 PEARL STREET
54 VANDEWATER ST

OFFICE: 185 SOUTH STREET

353 WATER STREET
5-7-9 JAMES SLIP

NEW YORK

A. SALOMON, Inc.

EMANUEL SALOMON, President

15 Park Row *New York*

Paper Makers Supplies

SOLE AGENTS U. S. *and* CANADA *for*

GASTON CAHEN & CO. *Ghent, Belgium*

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JEAN SOULIER *Rouen, France*

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Factory—WESTFIELD, MASS.

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ANIMAL SIZING · GLUE STOCK

LARGEST SPECIALISTS IN AMERICA ON

FINE WRITING PAPER SIZING

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Alum

(BOTH COMMERCIAL and FREE FROM IRON)

Casein, Satin White, English China Clay, Crystal Boro Phosphate

The

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THE WORLD'S BEST FILLER

ASBESTINE PULP

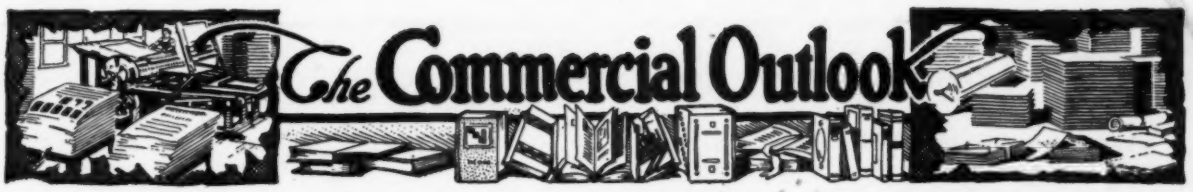
(Reg. U. S. Pat. Office)

Finest White Color Natural Fiber Retention 90%

Every Way Superior to Clay

Prompt Shipments Guaranteed—Largest Mills in the World

INTERNATIONAL PULP CO., 41 Park Row, New York



In the face of the reactionary trend that has set in during the past few weeks in various commodities, textiles and clothing in particular, the paper market remains exceedingly strong. Moreover, there are no visible signs of any approaching easiness in paper prices; on the contrary the tendency is still upward, and there have been further sharp advances in quite a number of cases during the past month. The reason for the continued firmness of the paper market is plainly evident. Prevailing commodity market conditions go to prove without the semblance of a doubt that despite the very high prices ruling, the paper situation as it exists today and as it has been for months past is profoundly healthy; that the proverbial law of supply and demand have put prices where they are, and that as long as a broad gap lies between the needs of consumers and the capacity of the country's paper mills that prices are destined to stay on high levels.

It is an axiom of the business world that when a period of depression arises, those industries wherein inflation exists are the ones first and chiefly affected. The average person has been aware that the excessive prices ruling on clothing of various descriptions in recent months was not due to any great increase in demand nor to a proportionate increase in manufacturing costs. It is not surprising that this industry is the one most directly involved in the wave of economy and close buying sweeping the country; neither is it to be marveled at that other industries marked by high prices created by artificial means have experienced a distinct change of complexion. The only apparent danger that present conditions hold out for the paper industry is that business in other lines might become so diminished that consumption of and demand for the various kinds of paper would be heavily reduced. Thus far there are no indications of this, and it is contended by conservative members of the trade that even should demand for paper suddenly drop off 20 to 30 per cent from what it now is that the market would not be materially affected for the reason that present demand is estimated on the average to be fully that much in excess of the capacity of the paper manufacturing plants of the country. There are those who frankly express a desire that demand for paper would decrease to about this extent because they believe a more stable market situation would ensue without any serious upset in prices.

It is an open secret that daily newspaper publishers in the large cities are keeping steadfastly out of the spot news print market, insofar as their pressing requirements will permit, thus abiding by their mutual agreement to give small consumers of print paper an opportunity to cover their needs for a time. Nevertheless there is an active and concerted demand for news print and such tonnages as find their way into the open market are quickly absorbed at firm prices. Spot shipments of news in standard rolls are selling at anywhere from 12 to 15 cents per pound and there is a tremendous potential demand that mills are unable to satisfy. Contract prices on news print are being repeatedly advanced. The International Paper Company has announced an increase of $15 per ton from $100 to $115 in its contract basis for the third quarter of this year, and the Canadian Export Paper Company, Ltd., has raised its price on news print a cent per pound from $90 to $110 a ton for the third quarter.

Book papers are in a strong market position and magazine publishers the country over are being obliged to limit their consumption because of being short of paper. Machine finished book is selling in the open market at 15 to 16 cents per pound and is extremely difficult to get for prompt shipment. Tissues and wrappings are firm in price and are actively sought. Fine papers are in pointed demand and have undergone additional sharp advancement in price. Board mills are sold out for months ahead and are simply unable to cope with the demand for their product. Higher prices rule on boards, plain chip freely commanding $115 and more a ton and news board from $125 upward.

First Pulp Mill in Alaska

The Union Iron Works, Bangor, Me., announce the receipt of an order for two wood pulp grinders (four pockets) for grinding 24-in. lengths of wood for the Alaska Pulp and Paper Co., together with two wet machines. This is the first pulp mill to be built in Alaska and Mr. E. P. Kennedy of San Francisco is the general manager of the company. The water wheels are to be furnished by the Pelton Water Wheel Co., San Francisco, and will operate under a 920 foot head.

The Union Iron Works have recently shipped to the Yokkaichi Paper Mfg. Co., Japan, three grinders and two wet machines. Their recent domestic shipments include twenty-seven grinders, four wet machines and ten screens.

Nilsen, Rantoul & Company, Inc., wood pulp importers and dealers, have removed their offices from 30 East Forty-second street to 140 Nassau street, New York.

Main Paper Stock Co.
Incorporated
PACKERS OF WASTE PAPER STOCK
Old and New Rags, Bagging, Strings, Etc.
Importers—Exporters
Daily Capacity 300 Tons
Branches: 321 Pearl Street, 423 East 132nd St.
General Offices and Warehouses: 25-31 Peck Slip, New York
Boston (Mass.) Office— 10 High St.
Holyoke (Mass.) Office—206 High St.

FRANCIS HUGHES COMPANY
Paper Mill Supplies
CORRESPONDENCE SOLICITED
Private Switch on C. B. & Q. Tracks
21st Street at Loomis
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Bleached Easy Bleaching
Unbleached Sulphites
Spruce and Poplar Ground Wood Pulp
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21 East 40th Street New York City
Dealers in Domestic Chemical and Mechanical Pulps and Paper
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J. & J. Rogers Company, Au Sable Forks, N. Y.
Canadian Kraft, Ltd.
Dealers in Wayagamack Kraft
Three Rivers, Canada
EASTERN AGENTS FOR
Port Huron, Michigan, Mitscherlich Sulphite
Made by Port Huron Sulphite & Paper Co., Port Huron, Mich.

TRY US ON WOOD PULP
Mechanical Ground Wood
Unbleached Sulphite
Bleached Sulphite
American, Canadian & Foreign Qualities
Invincible Paper and Pulp Corporation
A. GEORGE LUTZ, *President*
135 Broadway New York City
Long Distance Phone, Rector 9957

Papermaking Rags

The market for papermaking rags rules firm, especially so for this time of the year. Such changes in prices as have occurred during the past several weeks have been invariably in an upward direction, which is out of the ordinary when usually during the spring months the trend of the market is just the opposite. Various factors, including unfavorable railroad conditions, light collections of rags the country over and particularly in the South and Southwest where floods have been severe, and a large consumption by paper mills, however, make for steadiness in quotations, and there are members of the trade who, appreciating the voluminous needs of consumers as against the small accumulations of stock, are predicting a further rise in values before the inevitable reaction which all acknowledge must come sooner or later sets in. The sudden change in complexion of the clothing and wearing apparel market, resulting in a decreased output of garments of various kinds, is recognized as a bullish argument for new rags used by papermakers, and is being advanced by dealers and packers as a necessary reason for them securing full asked prices on new cuttings.

White rags lead in demand and some new high prices have been paid. Paper manufacturers are understood to be experiencing difficulty in obtaining ample bleaching materials, thus accounting for their absorbing proportionately larger amounts of white rags than colored.. Old No. 1 repacked whites are quotable at from 14 cents per pound upward, while new white shirt cuttings of No. 1 grade are bringing 19.50 to 20 cents. Roofing rags are quotably firm at a basic range of 3.25 to 3.50 cents for No. 1 packing. Repacked thirds and blues are selling at 4.75 cents, washables at 10.50 cents, unbleached muslins at 16 cents and fancy shirt cuttings at 12.50 cents. Quotations f. o. b. shipping points are:

New Stock—	New York and Chicago
White shirt cuttings, No. 1	19.50-20.00
White shirt cuttings, No. 2	13.00-13.50
Fancy shirt cuttings	12.50-13.00
Washables, No. 1	10.50-11.00
Unbleached muslins	16.00-16.50
White lawns	17.50-18.00
Overall cuttings, blue	13.00-13.50
Black silesias	7.50- 8.00
Old Stock—	
Whites, No. 1 repacked	14.00-16.00
Whites, No. 2 repacked	7.50- 8.00
Whites, house soiled	4.50- 4.75
Whites, street soiled	4.25- 4.50
Thirds and blues, repacked	4.75- 5.00
Thirds and blues, rough	4.00- 4.25
Black stockings	4.60- 4.80
Lace curtains	9.25- 9.50
Cotton canvas, No. 1	5.50- 6.00
White cotton batting	5.00- 5.25
Roofing, No. 1	3.25- 3.50
Roofing, No. 2	3.15- 3.25

Rope and Bagging

Demand from consuming sources for old ropes holds up well and supplies are moving forward to mills in good volume and at firm prices. Old Manila rope in No. 1 condition freely commands between 8.50 and 9 cents per pound at shipping points, although some lots of French rope have been obtained by mills at around 8.25 cents ex dock. The bagging market presents a tame and uninteresting appearance. Large buyers are mostly out of the running, due to their having stocked up earlier in the year with jute butts imported from India at low prices, and scrap bagging is available at relatively cheaper figures than any other kind of papermaking material. No. 1 scrap is quoted at around 3.25 cents per pound at shipping points and No. 1 gunny at 3.50 cents. Prices follow:

	New York and Chicago.
Gunny, No. 1 domestic	3.40-3.60
Gunny, No. 1 foreign	3.40-3.60
Scrap bagging, No. 1	3.25-3.50
Roofing bagging	2.50-2.75
Wool tares, heavy	3.75-4.00
Wool tares, light	3.50-3.75
Manila rope, No. 1 foreign	8.25-8.50
Manila rope, No. 1 domestic	8.50-9.00
Sisal strings	3.40-3.60
Mixed strings	3.10-3.25

Old Papers

Literally by leaps and bounds, prices on old papers have advanced to levels where they are at record-breaking heights. Mills have been actively in the market as buyers, and the concerted demand coupled with a reduction in supplies resulting from the curtailed operations of printers, publishers and other new paper consumers on account of the freight tie up have made for a steady uptrend in values. The rise in waste paper prices also can be attributed to

PAPER | RAGS

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Last year the combined plants of the Mendelson Bros. Paper Stock Co. handled an average of 300 tons of paper stock every day. Business expanded to an unheard-of degree.

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BECAUSE—the Mendelson organization is efficient, trustworthy and capable of handling this business. Since 1885 we have specialized in one thing until today we are recognized as one of the most reliable sources of supply for paper manufacturers.

BECAUSE—Our aim in conducting business is prompt shipments, correct service, and taking orders only that we can fill, and to pack only a clean uniform product throughout.

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no small extent to the wood pulp situation. With many paper and board manufacturers unable to get usual tonnage of pulp, they have been obliged to use larger quantities of old paper, thus creating a very heavy demand for the latter.

Practically every grade has shared in the advance, and high grades have risen in proportion to low qualities, and vice versa. Book paper mills are actively purchasing soft white shavings and are granting 6 to 6.25 cents per pound at shipping points for No. 1 packing, while old magazines have sold at 3.75 cents f. o. b. shipper's point. No. 1 hard white shavings are now quotable up to 7 cents a pound, old No. 1 kraft at 4.25 cents and ledger stock at 4 cents. Folded newspapers are selling at 2 cents per pound and more at shipping points and No. 1 mixed papers at 1.90 cents. Quotations follow:

	New York and Chicago.
Hard white shavings, No. 1	6.75-7.00
Hard white shavings, No. 2-3	5.50-6.25
Soft white shavings	6.00-6.25
Colored shavings	2.50-2.75
Heavy book, No. 1	3.70-3.80
Crumpled, No. 1	3.00-3.25
Ledger stock	3.80-4.00
Kraft, No. 1	4.00-4.25
Manilas, No. 1	2.40-2.60
White blank news	4.25-4.50
Overissue news, No. 1	2.30-2.40
Folded news	2.00-2.10
Mill wrappers	2.00-2.15
Box board cuttings	1.90-2.00
Mixed paper, No. 1	1.80-1.90
Common paper	1.10-1.20

Chemical Pulp

Following further advances in prices on most grades of chemical wood pulp, the sharp uptrend in the market seems to have been at least temporarily checked. Reports are to the effect that consumers are keeping out of the spot market insofar as their requirements will permit, and proof that this is so is not lacking, yet there is still more than sufficient demand to absorb the supplies offered and prices rule very firm. The situation has reached a point where it is exceedingly difficult to ascertain just what actual spot values are. Producers as a general thing have no pulp to divert to the open market, having foresold their output for some time ahead, and quotations can be based only on the scattered transactions put through off and on and the nominal asking prices of mills.

News print sulphite continues to range around 7 cents per pound at pulp mills, and there is little doubt that purchases have been made in some instances at beyond this level. Bleached sulphite is nominally quoted at as high as 11 cents for No. 1 domestic and in the vicinity of 14 cents for foreign

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BLEACHED AND UNBLEACHED
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Sarpsborg, Norway; Forshaga, and Edsvalla, Sweden;
Bergvik and Ala Nya Aktiebolag, Söderham, Sweden

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INCORPORATED
IMPORTERS DEALERS
ESTABLISHED 1895
Foreign and Domestic
Rags, Bagging, Rope
and Waste Paper
200-5th AVENUE, NEW YORK CITY

bleached. Kraft pulp is priced at about 7.25 cents for Scandinavian and between 6.75 and 7 cents for No. 1 domestic. Easy bleaching and Mitscherlich sulphites and soda pulp are virtually unavailable to transient buyers. Quotations on domestic pulps f. o. b. producing mills are:

Bleached sulphite	11.00-
Easy bleaching sulphite	8.50-9.00
News grade sulphite	6.50-7.00
Soda pulp, bleached	8.50-9.00
Mitscherlich unbleached	8.50-9.00
Kraft, No. 1	6.75-7.00
Screenings, refined	2.50-3.00

Mechanical Pulp

Under an active demand and unusually limited offerings of sizable tonnages, ground wood remains strong in price at from $100 to $110 per ton at grinding mills for spruce pulp of prime quality. Sales at as high as $115, and even $120, have been recorded in exceptional cases, and sellers are placed in a happy position where they can demand and get almost any price for immediate deliveries. More favorable climatic conditions are enabling manufacturers to increase their operations, yet the production is still inadequate to fill the wants of buyers, and offerings are snapped up as quickly as the pulp is put on the market. Indications are that prices have about reached their peak but there is no sign of impending easiness.

Chemicals

Sharp advances in many kinds of chemicals used by paper and pulp manufacturers have been recorded, and quotations continue to display a strong upward tendency. Railroad conditions have prevented producers from obtaining normal supplies of raw material, thereby curtailing production, and spot lots of chemicals of nearly every description have commanded premiums in price. Quotations range about as follows:

Alum, lump ammonia	4.25- 4.50
Alum, lump starch	8.50- 9.00
Alum, powdered	4.75- 5.00
Blanc fixe, powdered	5.50- 6.00
Bleaching powder (domestic drums)	4.75- 5.25
Brimstone (ton)	18.00-20.00
Casein	14.00-16.00
Caustic soda, spot delivery	6.50- 7.00
China clay, domestic, washed	10.00-12.00
China, clay, foreign	18.00-24.00
Rosin, grade E	18.90-
Satin white	2.25- 2.50
Soda ash, 58 per cent light (bags)	3.00- 3.50
Sulphite of alumina, commercial grade	2.00- 2.50
Starch, Globe, in bags	5.47-
Talc (ton)	18.00-20.00

BATHURST LUMBER COMPANY, LIMITED

PRICE & PIERCE, LTD.
30 East 42nd Street, NEW YORK CITY

ARE NOW THE

SOLE SELLING AGENTS
for Bathurst Pulp

Unbleached Sulphite 50 tons daily
Kraft Pulp 50 tons daily

Our pulp is made from Canadian Spruce
We ship in sheets, baled

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Colored rag	32-
Bonds—	
White rag	20-50
White sulphite	18-30
Colored sulphite	20-30
Colored rag	22-
Book—	
No. 1 S. & S. C	15.50-18.00
Machine finished	15.00-16.00
English finished	17.00-19.00
Coated and enameled	18.00-20.00
Lithograph, M. F	19.00-20.00
News Print—	
Rolls, contract	5.00- 5.50
Rolls, transient	12.00-
Sheets	Nominal
Side runs	7.00-
Cover Stock—	
Coated, both sides	12.25-
Coated, one side	12.20-
Wrappings—	
No. 1 kraft	11.00-12.00
No. 2 kraft	10.50-11.00
Boards—	New York and Chicago
Solid news	125.00-135.00
Straw	100.00-110.00
Plain chip	115.00-120.00
White coated chip	125.00-130.00
Manila coated chip	120.00-125.00
Binders board	135.00-145.00

The J. E. Linde Paper Company, paper jobbers of New York, has increased its capital stock from $600,000 to $1,250,000.

Louis Lemieux, formerly secretary and treasurer of the Tidewater Paper Mills Company, of Brooklyn, N. Y., and more recently connected with the Craig-Becker Company, Inc., of New York, pulp dealers and importers, sailed from New York on May 22 to assume his duties with Messrs. Becker & Company, in London, Eng.

News Personal

At a special meeting on May 17 at Portland, Me., stockholders of the Continental Paper Bag Company, of New York, authorized an increase in the capital stock of the corporation of the common from $2,500,000 to $7,500,000 and of the preferred from $2,500,000 to $5,000,000, and also voted to change the name of the company to the Continental Paper & Bag Mills. Considerable additions and improvements to the company's plants are contemplated and some of the increased capital will be used for this purpose, but none of the stock will be offered publicly.

The Harmon Paper Company, of Brownsville, N. Y., has increased its capital from $100,000 to $400,000. The Lockport Paper Company, Lockport, N. Y., manufacturers of roofing papers, has increased its capital stock from $150,000 to $1,000,000.

The mills, timberlands, water rights and property of the Dexter Sulphite Pulp and Paper Company, at Watertown, N. Y., have been purchased by William Randolph Hearst, publisher of the New York American and New York Evening Journal and a string of newspapers in a number of large cities in different parts of the country. While the price paid was not announced, it is variously rumored at between $3,000,000 and $5,000,000. Dr. James E. Campbell, president of the Dexter Corporation, and Dr. C. W. Campbell, vice-president, will continue in those positions and manage the mill, which they have owned for the past several years. The company has been manufacturing fibre wrapping, bag kraft and specialty papers, but both machines in the plant will now be devoted to making news print for the Hearst publications.

I. Frank Stone, formerly president of the National Aniline and Chemical Company and one of the leading manufacturing chemists of the country, died on May 5, at his home at 550 Park avenue, New York, in his fifty-fourth year. Mr. Stone was president of the National from 1906 until his retirement from active business last winter.

Hans Lagerloef, president of the Lagerloef Trading Company, Inc., wood pulp importers of 18 East Forty-first street, New York, recently returned from an extended trip to Finland where he made a detail study of pulp market conditions.

I can supply ten to twenty tons clean newspapers and magazines a month. Give me your best offer. Address, Box 30, care of The Paper Industry.

FOR SALE:

2—No. 8 Improved Paper Machinery Co. Save Alls
2—No. 10 Improved Paper Machinery Co. Save Alls
Good condition. Inspection invited.

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Thoroughly experienced storekeeper for pulp and paper mill in Northern Ontario. Must be conversant with paper and pulp machinery parts. Reply giving details of training, experience, salary expected. Also send small photo. Address Box 15, The Paper Industry.

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Chemical Pulp

Practically no chemical wood pulp is coming into the United States from foreign sources other than Canada unsold, and the lack of consigned supplies and the dire shortage of spot stocks place a damper on business, while the prices named by producers in Scandinavian countries act to discourage consumers here from placing orders for shipment pulp. There are a few scattered parcels of Scandinavian kraft pulp and No. 2 unbleached sulphite held in store at New York and Baltimore and importers are asking stiff prices for these supplies. All reports from both Norway and Sweden are of a distinctly discouraging character to paper manufacturers in the United States who have hoped that market conditions on the other side of the Atlantic would revert to a point where more pulp would be diverted to this market. Instead, Scandinavian mills are sold out for practically the balance of the year and are demanding unprecedented prices for such small supplies as they have to sell at intervals. Bleached sulphite is well nigh unobtainable at any price, while unbleached sulphite is quotable at around 9.50 cents per pound, Mitscherlich unbleached at 10 cents and kraft at 7.50 cents. Receipts at New York during May and nominal quotations follow:

Bleached sulphite	$14.00-
Unbleached sulphite, No. 1	9.50-10.00
Easy bleaching	10.50-11.00
Mitscherlich unbleached	10.00-10.50
Kraft	7.25- 7.50

Lagerloef Trading Co., Inc., 14,326 bales from Finland; Lagerloef Trading Co., Inc., 11,511 bales from Abo, Finland; J. Andersen & Co., 3,225 bales from Christiania; Ward Steamship Co., 300 bales from London; Irving National Bank, 3,309 bales from Hamburg; M. J. Corbett & Co., 18 bales from Bremen; New York Oversea Co., 300 bales from Brevik; Zinkeisen & Co., 6 bales from Hamburg; W. Schall & Co., 2,625 bales from Hamburg; A. J. Pagel & Co., 3 bales from Gothenburg; E. Halle, 3 bales from Gothenburg; Scandinavian-American Trading Co., 1,524 bales from Gothenburg; National Bank of Commerce, 375 bales from Gothenburg; Tidewater Paper Mills Co., 6,068 bales ground wood from Liverpool, N. S.

Paper Stock

There is no let up in the arrivals of papermaking raw material from European countries into the United States, and large tonnages have been received within the past month. The bulk of the rag stock imported continues to consist of roofing rags, which are being readily absorbed by felt mills at steady prices, and higher grade rags also are finding a prompt outlet among consuming mills. Importers maintain that they are experiencing increasing difficulty in getting rags on the other side owing to the depletion of stocks there, and assert that imports are likely to show a falling off during the next few months. Receipts at New York in May follow:

Old Rope

International Purchasing Co., 691 coils from Hull, 401 coils from Bristol, 629 coils from Rotterdam, 62 bales from Marseilles, 28 coils from Christiania; First National Bank of Boston, 494 coils from Hull; E. J. Keller Co., 12 bales from Lisbon, 121 bales from Antwerp; W. Schall & Co., 263 coils from Hull, 27 bales from Bordeaux, 52 bales from Barcelona; Irving National Bank, 318 bales from Hull; Heidelbach, Ickelheimer & Co., 100 bales from Hull, 128 coils from Leith; Mechanics & Metals National Bank, 194 bales from Colombo; Ladenburg, Thalman & Co., 51 coils from Gothenburg; Old Colony Trust Co., 513 coils from Bristol; Order, 67 bales from Hamburg, 85 bales from Stockholm, 66 bales from Gothenburg, 110 bales from Havre.

Old Bagging

Bank of New York, 173 bales from Antwerp; International Banking Corp., 39 bales from Antwerp; Wilkinson Bros. & Co., 165 bales from Hull; Mechanics & Metals National Bank, 150 bales from Liverpool; National City Bank, 417 bales from Rotterdam, 90 bales from Antwerp; Standard Bank of South Africa, 61 bales from Leith; Atlantic National Bank, 57 bales from Hull; Comptoir National d'Escompte de Paris, 30 bales from Antwerp, 18 bales from Bordeaux; Parsons & Whittemore, 94 bales from Rotterdam; Irving National Bank, 37 bales from Rotterdam; Mente & Co., 313 bales from Manchester; Maurice O'Meara Co., 120 bales from Manchester; First National Bank of Boston, 50 bales from Bordeaux; Order, 161 bales from London, 367 bales from Antwerp.

Rags

R. Goldstein & Son, 40 bales from Antwerp; American Woodpulp Corp., 212 bales from Hamburg; E. J. Keller Co., 83 bales from Lisbon, 951 bales from Rotterdam, 28 bales from Bordeaux; A. Salomon,

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The Carthage Chipper
BETTER THAN EVER

The Carthage Improved Chip Crusher
AS GOOD AS THE CHIPPER

The NEW Carthage Pulp Shredder
A REMARKABLE PERFORMER
IT DOES WHAT NO OTHER SHREDDER CAN DO

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KEEPS DIRT OUT OF YOUR SHEET

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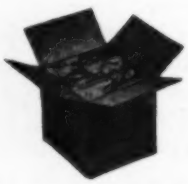
Paper Can Machinery

Complete sets of machinery for making cans such as are used for packing oats, coffee, baking powder, tobacco, snuff and cleansing powder.



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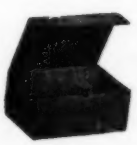

Paper Slitting and Rewinding Machines

Machines for cutting and rewinding roll paper. We build all width machines to handle any weight or thickness paper and any size roll.

Inc., 72 bales from Rouen, 621 bales from Antwerp; Paul Berlowitz, 22 bales from Rouen; J. Rosenberg, 444 bales from Hamburg; J. Salman, 114 bales from Bordeaux; Stone Bros., 126 bales from Havre; Main Paper Stock Co., 85 bales from Antwerp, 35 bales from Bordeaux; Castle, Gottheil & Overton, 271 bales from Havre, 641 bales from Rotterdam; Parsons & Whittemore, 108 bales from Havre, 783 bales from Antwerp, 1,163 bales from Rotterdam; Edwin Butterworth & Co., 925 bales from Antwerp, 58 bales from Havre; H. J. Reed, 39 bales from Bordeaux, 118 bales from Havre, 70 bales from Antwerp; Salomon Bros. & Co., 149 bales from Rotterdam; Maurice O'Meara Co., 2,336 bales from Bordeaux, 140 bales from Havre, 36 bales from Antwerp, 157 bales from Rotterdam; E. Marks & Co., 135 bales from Bordeaux; Dallas Waste Mills, 142 bales from Rotterdam; I. J. Hyman, 523 bales from Antwerp; W. Huges & Co., 216 bales from Rotterdam, 66 bales from Bordeaux; A. Katzenstein, 160 bales from Havre; George W. Millar & Co., 24 bales from Havre, 337 bales from Rotterdam; Wilkinson Bros. & Co., 260 bales from Hull, 244 bales from Antwerp; Albion Trading Co., 293 bales from London; Patent Vulcanite Roofing Co., 478 bales from Antwerp, 37 bales from Rotterdam; Certain-Teed Products Corp., 149 bales from Rotterdam; E. Gross & Co., 15 bales from Rotterdam; Jaffe & Co., 28 bales from Rotterdam; American Express Co., 52 bales from Bordeaux, 897 bales from Antwerp; Atlantic National Bank, 250 bales from Havre, 110 bales from Bordeaux, 83 bales from Antwerp; Irving National Bank, 492 bales from Antwerp, 319 bales from Havre; Guaranty Trust Co., 404 bales from Havre, 992 bales from Hull; Equitable Trust Co., 724 bales from Havre, 84 bales from Rouen, 916 bales from Rotterdam, 81 bales from Hull, 140 bales from Antwerp; National City Bank, 593 bales from Havre, 3,118 bales from Antwerp, 42 bales from Bordeaux; Standard Bank of South Africa, 71 bales from Havre, 113 bales from Bordeaux, 86 bales from Glasgow, 146 bales from Antwerp; Bank of New York, 1,458 bales from Antwerp; Mechanics & Metals National Bank, 170 bales from Antwerp, 20 bales from Hull; Citizens National Bank, 49 bales from Bordeaux, 159 bales from Havre, 134 bales from Hull, 160 bales from Antwerp; First National Bank of Boston, 1,726 bales from Hull; American Foreign Banking Corp., 246 bales from Havre, 192 bales from Bordeaux; International Purchasing Co., 11 bales from Hull; Garfield National Bank, 42 bales from Hull, 148 bales from Rotterdam; International Banking Corp., 790 bales from Antwerp; Ladenburg, Thalman & Co., 717 bales from Havre, 1,826 bales from Antwerp, 623 bales from Rouen, 795 bales from Rotterdam; Brown Bros. & Co., 1,504 bales from Antwerp, 99 bales from Havre; R. F. Downing & Co., 1,021 bales from Marseilles, 31 bales from Leith, 438 bales from Rotterdam; Goldman, Sachs & Co., 227 bales from Ant-

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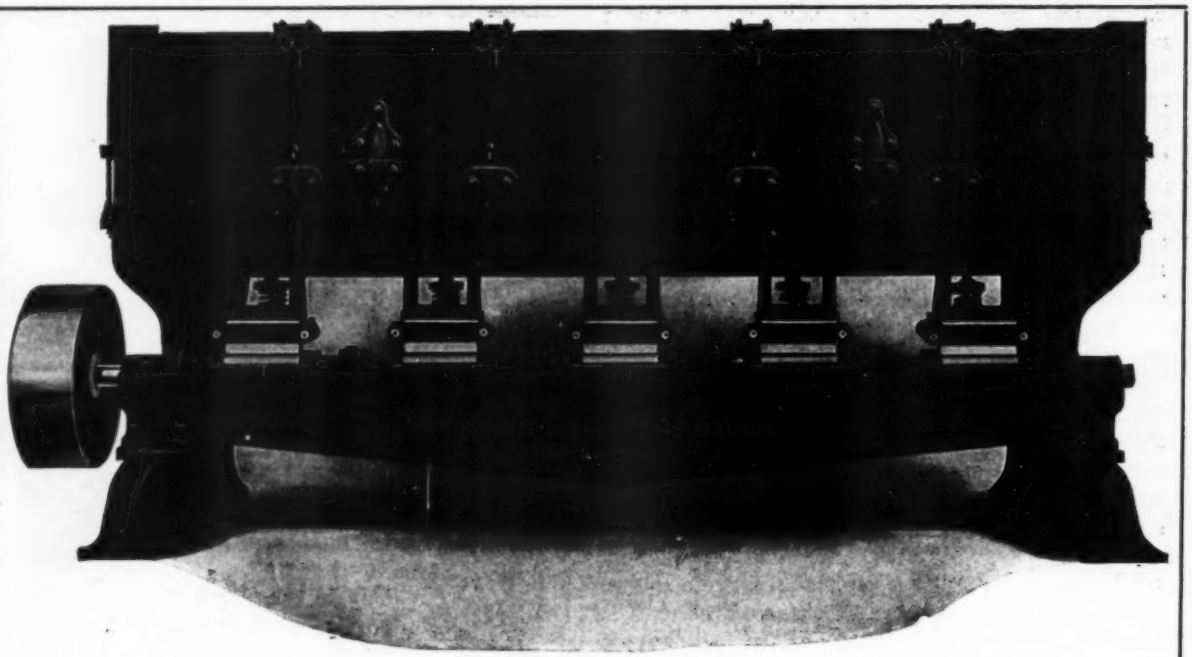

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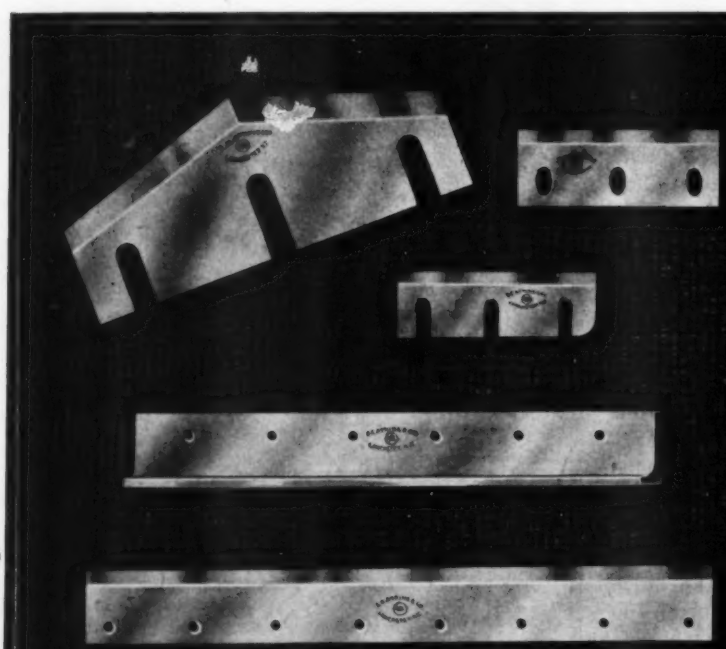

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werp, 640 bales from Havre, 624 bales from Bordeaux; W. Schall & Co., 1,136 bales from Havre, 143 bales from Antwerp, 122 bales from Bordeaux; Baring Bros. & Co., 498 bales from Antwerp; Heidelbach, Ickelheimer & Co., 395 bales from Antwerp, 50 bales from Bordeaux; Davies, Turner & Co., 187 bales from Antwerp, 246 bales from Rotterdam; Kelly & Co., 140 bales from Rotterdam; W. Van Doorn, 17 bales from Rotterdam; Sanderson & Son, 34 bales from Antwerp; Order, 2,647 bales from Bordeaux, 1,333 bales from London, 557 bales from Antwerp, 4,202 bales from Havre, 343 bales from Rouen.

Miscellaneous Paper Stock

First National Bank of Boston, 205 bales from London; Westport Paper Co., 207 bales from Liverpool; Mechanics & Metals National Bank, 140 bales from Antwerp; Atlas Waste Mfg. Co., 20 bales from Liverpool; S. Silberman & Co., 61 bales from Liverpool; Irving National Bank, 130 bales from Liverpool; American Exchange National Bank, 163 bales from Antwerp; Maurice O'Meara Co., 144 bales from Dundee; Equitable Trust Co., 42 bales from Dundee; Standard Bank of South Africa, 71 bales from London; Castle, Gottheil & Overton, 518 bales from Rotterdam; Guaranty Trust Co., 535 bales from Rotterdam, 56 bales from Manchester; R. F. Downing & Co., 76 bales from Manchester; National City Bank, 74 bales from Antwerp; Ladenburg, Thalman & Co., 204 bales from Antwerp; Edwin Butterworth & Co., 94 bales from Barcelona; Order, 50 bales from Liverpool, 80 bales from London.

Paper

The feature in the imports of paper during the past month is the relatively large quantities of hanging and cigarette papers, the bulk of the last grade coming, as usual, from France, while most of the hanging paper was imported from England. There were also several fair-sized shipments of news print paper received, yet, on the whole, paper imports continue considerably under the pre-war scale. Receipts at New York in May were as follows:

Cigarette

B. E. Teale, 55 cases from Oporto; Equitable Trust Co., 585 cases from Bordeaux; American Tobacco Co., 1,100 cases from Bordeaux, 144 cases from Havre; R. J. Reynolds Tobacco Co., 991 cases from Bordeaux; P. J. Schweitzer, 118 cases from Bordeaux, 111 cases from Havre; Liggett & Meyers Tobacco Co., 25 cases from Havre; South Pacific Co., 3 cases from Havre; Gluckmann Co., 13 cases from Havre; Western Pipe Co., 8 cases from Havre; Union Alliance Corp., 13 cases from Bordeaux; Tobacco Products Co., 20 cases from Bordeaux; M. J. Corbett & Co., 4 cases from Bordeaux; Foreign Paper Mills, 25 cases from Rotterdam; Globe Shipping Co., 50 cases from Antwerp; Order, 110 cases from Bordeaux.

We are prepared to deliver promptly in any desired quantity the following:

Auramine	Bismarck Brown
Basic Green	Pulp Colors
Chrysoidine R	Vegetable Tallow
Chrysoidine Y	Casein
Methyl Violet	Soda Ash
Orange	Caustic Soda
Basic News Blue	Bleaching Powder
Stearate of Calcium	Stearate of Alumina

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In so far as possible we will be glad to offer advice or suggestions to prospective buyers who are using or may be contemplating the use of brimstone.

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Paper Mill Machinery

The
NOBLE & WOOD MACHINE CO.
HOOSICK FALLS, N. Y.

YOUR PRODUCTION!

$$P = \frac{WTS}{600} - B$$

P=Production of salable paper in lbs. per hour.
W=Weight in lbs. of one ream (24 x 36-500).
T=Trim of paper in inches.
S=Speed of machine in feet per minute.
B=Lbs. per hour of paper lost in breaks or made unfit for sale.

Of the factors in the above formula by which you can determine YOUR production, T and W are fixed at predetermined values. But the values of S and B are variable and depend upon the equipment of the machine. Suction Rolls increase S and almost entirely eliminate B. The value of P then becomes much greater. Isn't that what YOU desire?

The Sandusky Foundry & Machine Co.
Sandusky, Ohio

Printing

National City Bank, 64 cases from Port Natal, 1,259 rolls from Stockholm; Guaranty Trust Co., 2,190 rolls from Stockholm; New York Oversea Co., 1,656 rolls from Christiania; Globe Shipping Co., 96 cases from Hamburg; Oxford University Press, 2 cases from Liverpool; B. F. Drakenfeld & Co., 11 cases from Liverpool; L. Frey, 10 cases from Rotterdam.

Filter

Lunham & Moore, 65 cases from London; J. Manheimer, 94 bales from Bordeaux; E. Fougera & Co., 112 cases from Bordeaux; F. B. Vandergrift & Co., 2 cases from London; Zinkeisen & Co., 31 cases from Hamburg; F. Henjes, 49 cases from Rotterdam.

Hanging

R. F. Lang, 25 bales from London; A. Murphy & Co., 5 bales from London, 16 bales from Liverpool; W. H. S. Lloyd & Co., 185 packages from London; Wolf Bros., 6 bales from Havre; Lenox Wall Paper Co., 3 bales from Havre; C. W. Fisher Furniture Co., 3 bales from Havre; E. Lecato & Co., 6 bales from Havre; A. C. Dodman, Jr., 61 bales from Liverpool; Hensel, Bruckmann & Lorbacher, 3 cases from Antwerp; R. Jacobs, 7 cases from Antwerp; A. E. Buckley, 4 cases from Liverpool; R. F. Downing & Co., 29 bales from London; Prager Co., 481 packages from Rotterdam; H. Van Doorn, 70 bales from Rotterdam; Order, 305 bales from London.

Drawing

Lunham & Moore, 12 cases from London; Scheuffel, Lasser Co., 38 cases from Hamburg; Winsor & Newton, 7 cases from London.

Writing

C. H. Boulin, 10 cases from Bordeaux.

Miscellaneous

R. Hoe & Co., 5 bales from London; Ichapirograph & Co., 40 cases from Hamburg; Irving National Bank, 34 cases from Antwerp; Globe Shipping Co., 20 cases from Antwerp, 9 cases from Hamburg; Japan Paper Co., 1 case from London; C. B. Richard & Co., 8 cases from Hamburg; Mansell, Hunt, Catty Co., 6 cases from London; T. Levin, 4 cases from London; H. Zimmern & Co., 7 cases from Havre; Kroons, Wilson & Co., 2 cases from Liverpool; Snows, Ltd., 2 cases from London; C. B. Stone & Co., 168 cases from Genoa; Defiance Mfg. Co., 18 cases from Marseilles; E. Dietzgen & Co., 24 cases from Marseilles, 1 case from London; Phoenix Shipping Co., 5 bales from Hamburg; Bernard, Judae & Co., 5 cases from Hamburg; F. H. Arnold & Co., 2 cases from London; Mexican Tile Co., 18 cases from London; Herbst Bros., 50 cases from Hamburg; N. Y. Label & Box Works, 5 cases from Rotterdam; Hensel, Bruckmann & Lorbacher, 13 cases from Rot-

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WE have a selling capacity twice our supply, and are in the market for paper in large volume, and would like to hear from you.

Our competent selling organization has from the beginning always demanded an ever increasing supply. We are at present all sold up and looking around for more, and are now in the market for five thousand tons in several grades.

We would be glad to hear from you what tonnage you can give us during this year. Write us.

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Grand Central Terminal, New York City

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Clay Coated Folding Box Board
Solid Manila Tag Board
Brown Jute Box Board
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Also other standard and special grades to order

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OUR list of Baling Press users looks like a roster of "Who's Who and Why."

Such institutions as Eastman Kodak, Curtis Publishing, Kellogg's Toasted Corn Flakes, and hundreds of other nationally known companies are users of The Famous Ohio.

The are all discriminating buyers. They have installed the Famous Ohio horizontal type baler, because it will do several times as much work as any vertical type machine.

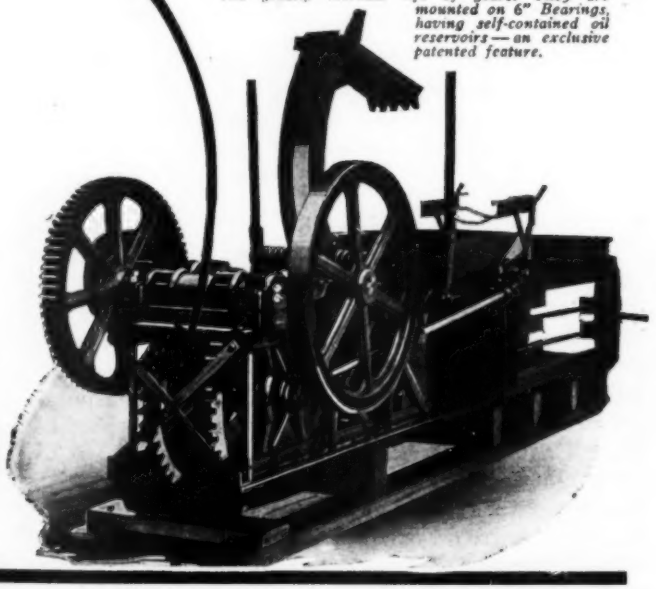
They know it to be a giant for strength, a demon for speed, and a mechanical masterpiece.

You probably need such a machine. Let us tell you more about it.

The Ohio Cultivator *Co.*

Bellevue, Ohio

The famous Ohio is a mechanical masterpiece. One important feature is the perfect system of driving and pinion gears which insures smoother operation, requires less power, and works without lost motion and noises. The large twin driving gears have two Pitman connecting points, which insure smooth, balanced drive and greatly increase life of gears. They are mounted on 6" Bearings, having self-contained oil reservoirs — an exclusive patented feature.



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Paper and Pulp Mills

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The Saw Makers

FITCHBURG, MASS. 5 Factories

CHICAGO, ILL. 12 Branches

terdam; Philadelphia National Bank, 54 bales from Hamburg; O. G. Hempstead & Sons, 2 cases from Hamburg; Kwong, Yuen Shing, 28 cases from Hong Kong; Charles W. Williams & Co., 28 cases from Antwerp; S. B. Hird & Co., 4 cases from London; Order, 130 bales from London.

Mr. A. George Lutz, formerly connected with the Hercules Engineering Corporation, New York City, has recently organized a new company known as the Invincible Paper & Pulp Corporation, 135 Broadway, New York City, of which he is president. The new company specializes in mechanical ground wood, bleached and unbleached sulphite, and imports large quantities from Sweden.

At a recent meeting of the Board of Directors of the International Paper Company, held in the company's general offices at 30 Broad street, New York, all the retiring officers were reelected for the ensuing year with the exception of W. D. Russell, vice-president, whose office was not filled. Philip T. Dodge was reelected president, Chester W. Lyman and W. E. Haskell, vice-presidents; Owen Shepherd, treasurer and F. G. Simons, secretary.

The Riordon Sales Company announce that they are now occupying their recently acquired premises at 367 Beaver Hall Square, Montreal, which gives them most ample facilities for taking care of their enlarged business for the Merritton, Hawkesbury and Kipawa sulphite products. During the absence of Mr. T. J. Stevenson in Europe for the summer, Mr. Geo. E. Challes will remain in charge of the office.

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STEBBINS ENGINEERING & MANUFACTURING CO.

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Contracts made for inspection service by the year. Know the paper mills thoroughly and have had 35 years of this class of service. Many Wisconsin mills now under contract.

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We cut, wash, renap, bind and pack for reshipment at the above prices in the natural color of felt, and in any quantity for mills or individuals. For dyeing any other color we charge 40 cents per pound extra. dry weight after material is washed.

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Rosin Size *English Clay* *Vegetable Tallow* *Textile Soaps* *Sulphonated Oils*

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Waterproof Case Lining

Protects your Shipments from damage by moisture while in storage or transit

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WE ALSO MAKE WAX PAPERS, ALL WEIGHTS, IN SHEETS OR ROLLS

Write for Samples

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Buyers' Guide—What and Where to Buy

Equipment, Apparatus, Supplies and Raw Materials Used by the Paper Industry

ADHESIVES
E. F. Russ Co., 201 Devonshire St., Boston, Mass.

ACID RESISTING BRONZE
Sandusky Foundry & Machine Co., Sandusky, Ohio.
William A. Hardy & Sons, Fitchburg, Mass.

AGITATOR EQUIPMENT
Dilts Machine Works, Fulton, N. Y.
The Hill Clutch Co., Cleveland, Ohio.
Moore & White Co., Philadelphia, Pa.

AIR CONDITIONING AND CONTROL APPARATUS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.

ANGLE VALES
The Crane Company, Chicago, Ill.

ARCHITECTS
James L. Carey, 208 N. Laramie St., Chicago.
L. A. De Guere, Grand Rapids, Wis.
Hardy S. Ferguson, 200 Fifth Ave., New York City.
George F. Hardy, 309 Broadway, New York City.

ASSORTING TABLES
Moore and White Co., Philadelphia, Pa.

ASH CONVEYOR SYSTEMS
American Steam Conveyor Corp., Chicago, Ill.

BALING PRESSES
Ohio Cultivator Co., Belleville, O.

BARKERS
Carthage Machine Co., Carthage, N. Y.
Holyoke Machine Co., Holyoke, Mass.
Union Iron Works, Bangor, Me.
Valley Iron Works Co., Appleton, Wis.

BARK SHREDDERS
The Jeffrey Mfg. Co., Columbus, O.

BEATER BARS
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATER BED PLATES
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATER ROLL FILLING
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
Simonds Manufacturing Co., Fitchburg, Mass.

BEATING, WASHING AND BLEACHING ENGINES
Dilts Machine Works, Fulton, N. Y.
Dayton Beater & Hoist Co., Dayton, Ohio.
Holyoke Machine Co., Holyoke, Mass.
Noble & Wood Machine Co., Hoosick Falls, N. Y.
Valley Iron Works Co., Appleton, Wis.

BEATERS (Continuous)
Claflin Engineering Co., Lancaster, Ohio.
The Griley-Unkle Eng. Co., Ft. Wayne, Ind.
Bird Machine Co., East Walpole, Mass.

BED PLATES
Dilts Machine Works, Fulton, N. Y.

BELTING (Rubber)
United States Rubber Co., New York and Chicago

BELT CONVEYORS
The Jeffrey Mfg. Co., Columbus, O.
Robins Conveying Belt Co., New York City.

BELT DRIVES
The Hill Clutch Co., Cleveland, Ohio.
The Link Belt Co., Chicago, Ill.

BLEACHING (Propellers)
Moore and White Co., Philadelphia, Pa.

BLANKETS
Frank F. Alt, 421 Columbia St., La Fayette, Ind.

BLOWERS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
B. F. Sturtevant Co., Hyde Park, Boston, Mass.

BOARD MACHINES
Beloit Iron Works, Beloit, Wis.
Valley Iron Works, Appleton, Wis.

Grasselli Chemical Co., Cleveland, Ohio.
A. Klipstein & Co., 644 to 652 Greenwich St., New York City.

DYNAMOS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

BOARDS (Straw)
The C. L. La Boiteaux Co., Cincinnati, O.

BOILERS
J. F. Davis, Chicago.

BOILER FEEDER
The Farnsworth Co., Conshohocken, Pa.

BOILER SETTINGS
McLeod & Henry Co., Troy, N. Y.

BRASS TUBES
Wheeler Condenser & Engineering Co., Carteret, N. J.

BRASS WIRE CLOTH
Appleton Wire Works, Appleton, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
Lindsay Wire Weaving Co., Cleveland, Ohio.
W. S. Tyler Co., Cleveland, Ohio.

BROKERS & FORWARDING AGENTS
Premier Shipping Co., 32 Broadway, N. Y. C.

BRIMSTONE
Union Sulphur Co., 17 Battery Place, New York City.

BRONZE CASTINGS
Eastwood Wire Mfg. Co., Columbus, O.

BRONZE JACKETS
Sandusky Foundry & Machine Co., Sandusky, Ohio.

BUNDLING SYSTEMS
Signode System, Lake St., Chicago

CALENDERS
Beloit Iron Works, Beloit, Wis.
Holyoke Machine Co., Holyoke, Mass.

CALENDER DOCTORS
Ticonderoga Machine Works, Ticonderoga, N.Y.

CALENDER ROLLS
Holyoke Machine Co., Holyoke, Mass.
B. F. Perkins and Son, Inc., Holyoke, Mass.

CASEIN
The Kalbfleisch Corp., 31 Union Square, N. Y. C.

CAST IRON PIPE
U. S. Cast Iron Mfg. Co., Pittsburgh, Pa.
Cast Iron Publicity Bureau, New York City.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.

CAUSTICIZING APPARATUS
Glamorgan Pipe & Foundry Co., Lynchburg, Va.

CENTRIFUGAL PUMPS
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
DeLaval Steam Turbine Co., Trenton, N. J.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Valley Iron Works Co., Appleton, Wis.
Wheeler Condenser & Engineering Co., Carteret, N. J.

CHEMICALS
Eastern Paper Makers' Chemical Co., Watertown, N. Y.
The Grasselli Chemical Co., Cleveland, Ohio.
A. Klipstein & Co., 644 to 652 Greenwich St., New York City.
Paper Makers' Chemical Co., Easton, Pa., and Holyoke, Mass.
Mathieson Alkali Works, Inc., New York City.
Western Paper Makers' Chemical Co., Kalamazoo, Mich.

CHIP CRUSHERS
Carthage Machine Co., Carthage, N. Y.

CHIPPERS
Holyoke Machine Co., Holyoke, Mass.
Union Iron Works, Bangor, Me.
Valley Iron Works Co., Appleton, Wis.

CHIPPER AND BARKER KNIVES
John W. Bolton & Sons, Inc., Lawrence, Mass.
Dilts Machine Works, Fulton, N. Y.
Simonds Manufacturing Co., Fitchburg, Mass.
R. J. Dowd Knife Works, Beloit, Wis.

CHIP SCREENS
Carthage Machine Co., Carthage, N. Y.

CLAYS AND FILLERS
Binney & Smith Co., 81 Fulton St., N. Y. C.
Daniel M. Hicks, 200 Fifth Ave., New York City.
Eastern Paper Makers' Chemical Co., Watertown, N. Y.
International Pulp Co., 41 Park Row, N. Y. C.
Miner-Edgar Co., 30 Church St., New York City.
Paper Makers' Chemical Co., Easton, Pa., and Holyoke, Mass.
The John W. Higman Co., Inc., 29 Broadway, New York City.
Western Paper Makers' Chemical Co., Kalamazoo, Mich.

COAL BUNKERS
The Brownhoist Co., Cleveland, Ohio.
The Jeffrey Mfg. Co., Columbus, O.

COAL & ASH HANDLING SYSTEMS
Godfrey Conveyor Co., 119 13th St., Elkhart, Ind.
The Jeffrey Mfg. Co., Columbus, O.

COATED PAPERS
Bardeen Paper Co., Otsego, Mich.
Bermingham & Prosser, Chicago, Ill.
Bryant Paper Co., Kalamazoo, Mich.
Monarch Paper Co., Kalamazoo, Mich.
Seaman Paper Co., Chicago, Ill.

CONDENSING EQUIPMENT
Wheeler Condensing & Engineering Co., Carteret, N. J.

CONSTRUCTION (Building)
The Aladdin Co., Bay City, Mich.

CONSULTING ENGINEERS
James L. Carey, 208 N. Laramie St., Chicago, Ill.
Hardy S. Ferguson, 200 Fifth Ave., New York City.
George F. Hardy, 309 Broadway, New York City.

CONSULTING ENGINEERS (Power)
J. P. Carrigan Engineering Co., 504 Cunard Bldg., Chicago.

CONVEYORS
Godfrey Conveyor Co., 119 13th St., Elkhart, Ind.
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Portable Machine Co., Passaic, N. J.
Robins Conveying Belt Co., New York City.

COOLING TOWERS
Wheeler Condenser & Engineering Co., Carteret, N. J.

COPPER TUBES
Wheeler Condenser & Engineering Co., Carteret, N. J.

CRANES
The Brownhoist Co., Cleveland, Ohio.
John F. Byers Co., Ravenna, Ohio.
Northern Engineering Works, Detroit, Mich.
The Chisholm-Moore Mfg. Co., Cleveland, O.
The Link Belt Co., Chicago, Ill.

CRUSHERS (Coal)
The Jeffrey Mfg. Co., Columbus, O.

CYLINDER MOLDS
Appleton Wire Works, Appleton, Wis.
Beloit Iron Works, Beloit, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
Eastwood Wire Mfg. Co., Belleville, N. J.
The Lindsay Wire Weaving Co., Cleveland, O.
Joseph O'Neill Wire Works, Southport, Conn.
W. S. Tyler Co., Cleveland, Ohio.

DANDY ROLLS
Appleton Wire Works, Appleton, Wis.
Central Mfg. Co., Kalamazoo, Mich.
Cheney Bigelow Wire Works, Springfield, Ohio.
Eastwood Wire Mfg. Co., Belleville, N. J.
Lindsay Wire Weaving Co., Cleveland, Ohio.
W. S. Tyler Co., Cleveland, Ohio.

DECKEL FRAME SUPPORTS
Huband and Nash, Menasha, Wis.

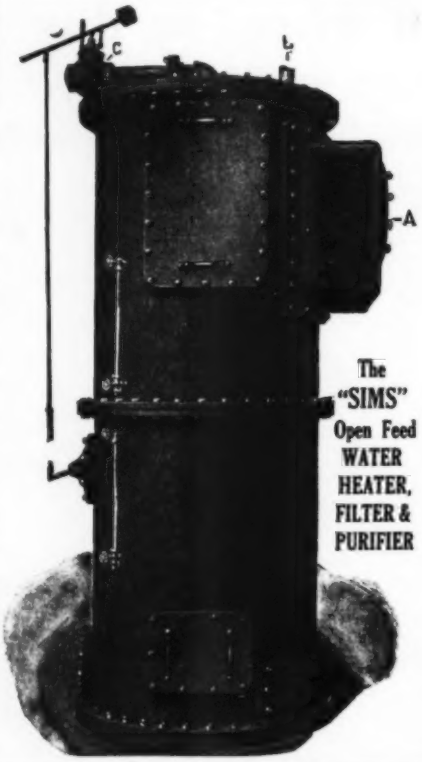
DERRICKS
Continental Bridge Co. Chicago, Ill.

DRIVES (Lenix)
F. L. Smidth & Co., 50 Church St., N. Y. City.

DRUM WINDERS
Beloit Iron Works, Beloit, Wis.
Ticonderoga Machine Co., Ticonderoga, N. Y.

DRYER FELTS
Albany Felt Co., Albany, N. Y.
Appleton Woolen Co., Appleton, Wis.
F. C. Huyck & Sons.
Shuler and Benninghofen, Hamilton, Ohio.

DYESTUFFS
Binney & Smith, 81-83 Fulton St., N. Y. City.
E. I. Du Pont de Nemours & Co., Wilmington, Del.



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WHEN you buy a water heater, or anything else for that matter, you do not actually buy a water heater, but what it will do.

"SIMS" Open Feed Water Heater, Filter and Purifier is the product of Modern Engineering Science and has met the demand for greater efficiency.

OPEN FEED construction is the most simple and effective principle of feed water heating and has less maintenance troubles and operating costs than any other type.

WATER HEATER feeds your boilers with hot water, reduces the strain from contraction and expansion due to feeding cold water and effects a saving of approximately 14.5% in fuel.

FILTER the feed water in a filtering chamber containing hard coke of suitable size as the filtering medium.

and

PURIFIER Water containing earthy matter and carbonate of lime when heated close to the boiling point is thrown out of solution into suspension and is removed by the filter.

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"We Keep Others in Hot Water."

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Buyers' Guide—What and Where to Buy

Equipment, Apparatus, Supplies and Raw Materials Used by the Paper Industry

DUST COLLECTING SYSTEMS
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.

ELECTRICAL ENGINEER
Wm. D. Kurz, Appleton, Wis.

ELECTRIC HOISTS
John F. Byers Machine Co., Ravenna, Ohio.
Link-Belt Co., Chicago, Ill.
Northern Engineering Co., Detroit, Mich.

ELECTRIC MACHINERY
Westinghouse Elec. & Mfg. Co. East Pittsburgh, Pa.

ELEVATORS
The Jeffrey Mfg. Co., Columbus, O.

ELEVATORS (Portable)
The Jeffrey Mfg. Co., Columbus, O.

ENGINES
Ball Engine Co., Erie, Pa.
The Brownell Co., Dayton, O.
Chandler and Taylor, Indianapolis, Ind.
Hooven, Owens, Rentschler Co., Hamilton, Ohio.

ENGINEERS
James L. Carey, 208 North Laramie St., Chicago, Ill.
John F. Carrigan, Chicago, Ill.
George F. Hardy, 309 Brodway, New York City.
Hardy S. Ferguson, 200 Fifth Ave., New York City.
Stebbins Engineering & Mfg. Co., Watertown, N. Y.

ENGINEERS (Testing)
Widney Test Laboratories, Chicago, Ill.

EVAPORATORS:
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Charles Ordway, 25 Church St., N. Y. City.
Swenson Evaporator Co., Chicago, Ill.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Zaremba Co., Buffalo, N. Y.

EXHAUSTERS
Glamorgan Pipe & Foundry Co., Lynchburg, Va.

FANS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
B. F. Sturtevant Co., Hyde Park, Boston, Mass.

FELTS AND JACKETS
Albany Felt Co., Albany, N. Y.
Appleton Woolen Co., Appleton, Wis.
F. C. Huyck & Sons, Albany, N. Y.
Shuler and Benninghofen, Hamilton, Ohio.
Waterbury Felt Co., Skaneateles Falls, N. Y.

FELT AND WIRE GUIDES
Huband and Nash, Menasha, Wis.
Moore & White Co., Philadelphia, Pa.

FIBROUS PEARL FILLER
Eastern Paper Makers' Chemical Co., Watertown, N. Y.
Paper Makers' Chemical Co., Easton, Pa., and Holyoke, Mass.
Western Paper Makers' Chemical Co., Kalamazoo, Mich.

FILTER (Continuous Suction)
Glamorgan Pipe & Foundry Co., Lynchburg, Va.

FILTERS (Pressure and Gravity)
Graver Corporation, East Chicago, Ind.

FIRE BRICK
Oliver Bros., 97 Warren St., New York City.

FLY BARS
Dilts Machine Works, Fulton, N. Y.

FOURDRINIER WIRES
Appleton Wire Works, Appleton, Wis.
Cheney Bigelow Wire Works, Springfield, Mass.
Eastwood Wire Mfg. Co., Belleville, N. J.
Lindsay Wire Weaving Co., Cleveland, Ohio.
Joseph O'Neill Wire Works, Southport, Conn.
W. S. Tyler Co., Cleveland, Ohio.

FRICTION CLUTCHES
The Hill Clutch Co., Cleveland, Ohio.
Moore and White Co., Philadelphia, Pa.

FURNACE ARCHES
McLeod & Henry Co., Troy, N. Y.

FUSES
Economy Fuse & Mfg. Co., Kinzie and Orleans Sts., Chicago, Ill.

GATE HOISTS FOR HYDRAULIC INSTALLATIONS
Dilts Machine Works, Fulton, N. Y.

GEARS
The Hill Clutch Co., Cleveland, Ohio.

GLUES
E. F. Russ Co., 201 Devonshire St., Boston, Mass.

GRINDERS
Holyoke Machine Co., Holyoke, Mass.
Valley Iron Works, Appleton, Wis.

HEAD GATE HOISTS
Dilts Machine Works, Fulton, N. Y.

HEATERS (Feed Water)
Graver Corporation, East Chicago, Ind.
The Sims Co., Erie, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.

HOISTING AND CONVEYING SYSTEMS
John F. Byers Machine Co., Ravenna, Ohio.
The Chisholm-Moore Mfg. Co., Cleveland, Ohio.
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Northern Engineering Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.

HOSE
United States Rubber Co., Chicago, Ill.

HYDRAULIC HEAD GATE HOISTS
Dilts Machine Works, Fulton, N. Y.

HYDRAULIC TURBINES
Holyoke Machine Co., Holyoke, Mass.
James Leffel and Co., Springfield, Ohio.
S. Morgan Smith Co., York, Pa.

INDUSTRIAL HOUSES
The Aladdin Co., Bay City, Mich.

INSTRUMENTS (Testing)
Widney Test Laboratories, Chicago, Ill.

IRON CASTINGS
Beloit Iron Works, Beloit, Wis.
Valley Iron Works Co., Appleton, Wis.

JORDAN FILLINGS
J. W. Bolton & Sons, Inc., Lawrence, Mass.

KNIVES
E. C. Atkins & Co., Indianapolis, Ind.
John W. Bolton & Sons, Inc., Lawrence, Mass.
R. J. Dowd Knife Works, Beloit, Wis.
Simonds Manufacturing Co., Fitchburg, Mass.

LAYBOYS
Moore and White Co., Philadelphia, Pa.

LIFT TRUCKS
Sturdi-Truck Mfg. Co., Holyoke, Mass.

KNIFE GRINDING MACHINERY
Machinery Co. of America, Big Rapids, Mich.

LIGHTING EQUIPMENT
Benjamin Electric Co., Chicago, Ill.

LINE SHAFT BEARINGS
The Hill Clutch Co., Cleveland, Ohio.

MACHINE DRYER TEMP. CONTROL
Open Coil Heater and Purifier Co., Indianapolis, Ind.
Valley Iron Works, Appleton, Wis.

MAGNETIC PULLEYS
Magnetic Mfg. Co., 766 Windlake Ave., Milwaukee, Wis.

MECHANICAL DRAFT APPARATUS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
B. F. Sturtevant Co., Hyde Park, Boston, Mass.

MECHANICAL PULP
J. Andersen & Co., 21 E. 40th St., New York City.

MECHANICAL STOKERS
Sanford Riley Stoker Co., Worcester, Mass.

METERS (Gasoline)
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

MILL ARCHITECTS
Stebbins Engineering & Mfg. Co., Watertown, N. Y.

MOISTURE TESTER
Williams Apparatus Co., Watertown, N. Y.

MOTORS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

OIL FILTRATIONS & CIRCULATING SYSTEMS
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

OIL HANDLING AND STORING EQUIPMENT
The Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

PAINTS
Cheesman-Elliot, Inc., New York City.
Detroit Graphite Co., Detroit, Mich.
The Tropical Paint & Oil Co., Cleveland, O.

PAPER BOARDS
The C. L. La Boiteaux Co., 200 Fifth Ave., N. Y.
Strehl Otens Co., Inc., New York-Chicago.

PAPER CUTTERS & SLITTERS
Beloit Iron Works, Beloit, Wis.
Hamblet Machine Co., Lawrence, Mass.

PAPER DISTRIBUTORS
Bermingham and Prosser, Chicago, Ill.
H. G. Craig & Co., New York City.
Berton C. Hill Co., New York City.
Maurice O'Meara, New York City.
Seaman Paper Co., Chicago, Ill.

PAPER EXPORTERS AND IMPORTERS
Gatti-McQuade Co., 200 Fifth Ave., New York City.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
Main Paper Stock Co., 23-31 Peck Slip, New York City.
New York Overseas Co., 17 Battery Place, New York City.
Interstate Pulp and Paper Co., Grand Central Bldg., New York City.
Lagerloef Trading Co., 18 E. 41st St., N. Y. C.
Parsons Trading Co., 17 Battery Place, N. Y. C.

PAPER MACHINES
Beloit Iron Works, Beloit, Wis.

PAPER MANUFACTURERS
American Writing Paper Co., Holyoke, Mass.
Bardeen Paper Co., Otsego, Mich.
Eastern Manufacturing Co., 501 Fifth Ave., N. Y. City.
Hammermill Paper Co., Erie, Pa.
Lakeside Paper Co., Neenah, Wis.
Lincoln Paper Mills, Elkhart, Ind.
Marathon Paper Co., Rothschild, Wis.
Munising Paper Co., Munising, Mich.
Northern Paper Mills, Green Bay, Wis.
Oxford Paper Co., 200 Fifth Ave., N. Y. City.
The Racquette River Paper Co., Potsdam, N. Y.
State Pulp & Paper Co., New York City.
Wausau Sulphate Fibre Co., Mosinee, Wis.
Wolverine Paper Co., Otsego, Mich.

PAPER MANUFACTURERS' SUPPLIES
J. Andersen & Co., 21 East 40th St., New York City.
Vito G. Cantasano & Bros., 185 South St., New York City.
Craig-Becker Co., 52 Vanderbilt Ave., N. Y. City.
Eastern Paper Makers' Chemical Co., Watertown, N. Y.
General Naval Stores Co., 90 West St., N. Y. C.
Francis Hughes Co., 21st St. and Loomis Ave., Chicago.
Invincible Paper & Pulp Corporation, 135 Broadway, N. Y. City.
Gatti-McQuade Co., 200 Rifth Ave., New York City.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
Martin Spinelli, 132 Nassau St., New York City.
Main Paper Stock Co., 25-31 Peck Slip, New York City.
Mendelson Bros. Paper Stock Co., 910 Michigan Ave., Chicago.
New York Overseas Co., Inc., 17 Battery Place, New York City.
Paper Makers' Chemical Co., St. Austell, England.
A. Salomon, Inc., New York City.
Salomon Bros. & Co., 200 Fifth Ave., N. Y. C.
Spinelli, Martin, Brooklyn, N. Y.
Steele By-Products Co., Chicago.
Western Paper Makers' Chemical Co., Kalamazoo, Mich.

PAPER MILL BROKERS
Frank H. Davis, 175 Richdale Ave., Cambridge, Mass.
Gibbs-Brower Co., 261 Broadway, N. Y. C.

PAPER STOCK CUTTERS
Taylor, Stiles & Co., Riegelsville, N. J.

PAPER PULPING ENGINES
Noble & Wood Machine Co., Hoosick Falls, N. Y.

PAPER AND PULP MILL MACHINERY
Beloit Iron Works, Beloit, Wis.
The Sandy Hill Iron & Brass Works, Hudson Falls, N. Y.

PAPER TESTERS
Widney Test Laboratories, Chicago, Ill.

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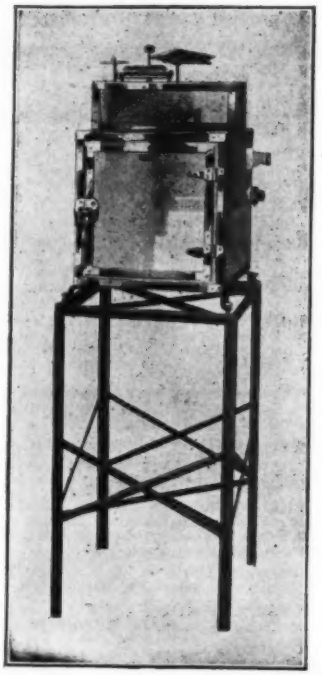

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Equipment, Apparatus, Supplies and Raw Materials Used by the Paper Industry

PARCHMENT MANUFACTURERS
Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.
Sutherland Paper Co., Kalamazoo, Mich.

PIPE BENDING
American Pipe Bending Co., Boston, Mass.

PIPING EQUIPMENT
Pittsburgh Piping & Equip. Co., Pittsburgh, Pa.

PIPING SYSTEMS INSTALLED
Pittsburgh Piping & Equip. Co., Pittsburgh, Pa.

PLUG MACHINES
Carthage Machine Co., Carthage, N. Y.

PNEUMATIC CHIP HANDLING SYSTEMS
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.

POWER INSTRUMENTS
The Manning Gauge Co., Inc., 77 Traverse St., Boston, Mass.

POWER TRANSMISSION
Dodge Sales & Engineering Co., Mishawaka, Ind.
Link-Belt Co., Chicago, Ill.
F. L. Smidth & Co., 50 Church St., N. Y. C.
The Hill Clutch Co., Cleveland, Ohio.
Valley Iron Works, Williamsport, Pa.

PUBLISHERS
The Chemical Catalog Co., New York City.
Ravenswood Press Pub. Co., Chicago, Ill.

PULP (Chemical)
J. Andersen & Co., 21 East 40th St., New York City.
Craig-Becker Co., 52 Vanderbilt Ave., N. Y. City.
Daniel M. Hicks, 200 Fifth Ave., New York City.
E. J. Keller Company, 200 Fifth Ave., N. Y. C.
New York Overseas Co., Inc., 17 Battery Place, New York City.
Price & Pierce, Ltd., 30 East 42nd St., New York City.
The Pulp & Paper Trading Co., 21 East 40th St., New York City.
Scandinavian-American Trading Co., 50 East 42d St., New York City.
Lagerloef Trading Co., 18 E. 41st St., N. Y. C.

PULP EXTRACTORS
The Griley-Unkle Eng. Co., Ft. Wayne, Ind.

PULP AND PAPER MACHINERY
Beloit Iron Works, Beloit, Wis.
Bird Machine Co., East Walpole, Mass.
Carthage Machine Co., Carthage, N. Y.
Glens Falls Machine Co., Glens Falls, N. Y.
Moore & White Co., Philadelphia, Pa.
Union Iron Works, Bangor, Me.
Valley Iron Works, Appleton, Wis.

PULP GRINDERS
Carthage Machine Co., Carthage, N. Y.
Union Iron Works, Bangor, Me.

PULP LAP SHREDDERS
The Jeffrey Mfg. Co., Columbus, O.

PULP SHREDDERS
Carthage Machine Co., Carthage, N. Y.

PUMPS (Stock)
Beloit Iron Works, Beloit, Wis.
Buffalo Steam Pump Co., Buffalo, N. Y.
Carthage Machine Co., Carthage, N. Y.
Glens Falls Machine Co., Glens Falls, N. Y.

PUMPS (Centrifugal)
Wheeler Condenser & Engineering Co., Carteret, N. J.

PUMPS (Gasoline)
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

PUMPS (Vacuum)
American Steam Pump Co., Battle Creek, Mich.
Buffalo Foundry and Machine Co., Buffalo, N. Y.
Dean Bros., Indianapolis, Ind.
Wheeler Condenser & Engineering Co., Carteret, N. J.

RAG AND PAPER DUSTERS
Holyoke Machine Co., Holyoke, Mass.

RAG CUTTER KNIVES
Dilts Machine Works, Fulton, N. Y.

REFLECTORS
Benjamin Electric Co., Chicago, Ill.

ROTARY VACUUM PUMPS
Sandusky Foundry & Machine Co., Sandusky, O.

ROSIN
General Naval Stores Co., 90 West St., N. Y. C.

RUBBER ROLLS
United States Rubber Co., New York and Chicago

ROOF TRUSSES
Continental Bridge Co., Chicago, Ill.

ROTARY SCREEN
Bird Machine Co., East Walpole, Mass.

SAVE-ALLS
Bird Machine Co., East Walpole, Mass.
Diamond State Fibre Co., Bridgeport, Pa.
Glens Falls Machine Co., Glens Falls, N. Y.

SAWS
E. C. Atkins & Co, Indianapolis, Ind.
Simonds Manufacturing Co., Fitchburg, Mass.

SCREENS
Bird Machine Co., East Walpole, Mass.
Shartle Bros. Mach. Co., Middletown, O.
Union Iron Works, Bangor, Me.

SCREEN PLATES
Central Mfg. Co., Kalamazoo, Mich.
William A. Hardy & Sons, Fitchburg, Mass.

SCREEN DIAPHRAGMS
United States Rubber Co., Chicago, Ill.

SECOND HAND MACHINERY
Frank H. Davis, 175 Richdale Ave., Cambridge, Mass.

SHAKE (Fourdrinier Cushion)
Wm. C. Nash, Neenah, Wis.

SHOWER PIPES
Sandusky Foundry and Machine Co., Sandusky, Ohio.

SILENT CHAIN DRIVES
The Link Belt Co., Chicago, Ill.

SIZING SYSTEMS
Eastern Paper Makers' Chemical Co., Watertown, N. Y.
Paper Makers' Chemical Co., Easton, Pa., and Holyoke, Mass.
Process Engineers, New York City.
Western Paper Makers' Chemical Co., Kalamazoo, Mich.

SLITTING AND REWINDING MACHINERY
Beloit Iron Works, Beloit, Wis.
Hamblet Machine Co., Lawrence, Mass.
Samuel M. Langston Co., Camden, N. J.

SOOT BLOWERS
Diamond Power Specialty Co., Detroit, Mich.

SPEED CHANGES
Moore and White Co., Philadelphia, Pa.

STEAM JET CONVEYORS
American Steam Conveyor Corp., Chicago, Ill.

STOCK CIRCULATING SYSTEM
Claflin Engineering Co., Lancaster, Ohio.
Ticonderoga Machine Works, Ticonderoga, N.Y.

STOCK PUMPS
Beloit Iron Works, Beloit, Wis.
Buffalo Steam Pump Co., Buffalo, N. Y.

STUFF CHEST AGITATORS
Dilts Machine Works, Fulton, N. Y.

SUCTION ROLLS
Sandusky Foundry and Machine Co., Sandusky, Ohio.

SULPHITE MACHINERY
Stebbins Engineering Co., Watertown, N. Y.

SULPHUR
Union Sulphur Co., 17 Battery Place, New York City.

SULPHUR BURNERS
Carthage Machine Co., Carthage, N. Y.
Valley Iron Works Co., Appleton, Wis.

TANKS (Oil Storage)
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.
Graver Corporation, East Chicago, Ind.

TANKS (Steel)
Graver Corporation, East Chicago, Ind.

TANKS (Welded)
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

TANKS (Water Storage)
Graver Corporation, East Chicago, Ind.

TESTERS (Moisture)
Williams Apparatus Co., Watertown, N. Y.

TRUCKS
Sturdi-Truck Mfg. Co., Holyoke, Mass.

TUBING
Wheeler Condensing & Engineering Co., Carteret, N. J.

TURBINES (Hydraulic)
James Leffel and Co., Springfield, Ohio.
S. Morgan Smith Co., York, Pa.

VACUUM SYSTEMS
Open Coil Heater and Purifier Co., Indianapolis, Ind.

VALVES
Carthage Machine Co., Carthage, N. Y.
The Crane Co., Chicago, Ill.
G. M. Davis Regulator Co., 414 Milwaukee Ave., Chicago, Ill.
The Wm. Powell Co., Cincinnati, Ohio.
Voorhees Rubber Mfg. Co., Jersey City, N. J.

VALVES (Strainer)
Bird Machine Co., East Walpole, Mass.

VAPOR ABSORPTION SYSTEMS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
B. F. Sturtevant Co., Hyde Park, Boston, Mass.

VARIABLE SPEED ENGINES
Ball Engine Co., Erie, Pa.
The Brownell Co., Dayton, Ohio.
Chandler and Taylor, Indianapolis, Ind.
Hooven, Owens, Rentschler Co., Hamilton, O.

VENTILATING SYSTEMS
American Blower Co., Detroit, Mich.
Bayley Mfg. Co., 732 Greenbush St., Milwaukee, Wis.
B. F. Sturtevant Co., Hyde Park, Boston, Mass.

WASHER WIRES
The W. S. Tyler Co., Cleveland, Ohio.

WASTE PAPER STOCK
Gatti-McQuade Co., 200 Fifth Ave., New York City.
Francis Hughes Co., 21st and Loomis Street, Chicago.
Main Paper Stock Co., 23-31 Peck Slip, New York City.
F. G. Marquardt, Inc., 345 Broadway, N. Y. C.
Martin Spinelli, 132 Nassau St., New York City.
Mendelson Bros. Paper Stock Co., 910 S. Michigan Blvd., Chicago, Ill.
Salomon Bros. & Co., 200 Fifth Ave., N. Y. C.

WATCHMAN'S CLOCKS
Chicago Watchman's Clock Works, 1526 Wabash Ave., Chicago.

WATER FILTER
Glens Falls Machine Co, Glens Falls, N. Y.

WATER HEATERS:
Graver Corporation, East Chicago, Ill.
The Sims Co., Erie, Pa.

WATERPROOF LINING
The National Waterproofing Co., Philadelphia, Pa.

WATER-SOFTENING AND PURIFYING SYSTEMS
Graver Corporation, East Chicago, Ind.
Wm. B. Scaife and Sons Co., Oakmont, Pa.

WATER WHEELS
James Leffel and Co., Springfield, Ohio.
Holyoke Machine Co., Holyoke, Mass.
S. Morgan Smith Co., York, Pa.

WET MACHINES
Carthage Machine Co., Carthage, N. Y.
Valley Iron Works Co., Appleton, Wis.

WOOD CHIP SHREDDERS
The Jeffrey Mfg. Co., Columbus, O.

WOOD SPLITTERS
Carthage Machine Co., Carthage, N. Y.

WOOD WASHERS
Carthage Machine Co., Carthage, N. Y.

WIRE SIGNS
Cheney Bigelow Wire Works, Springfield, Mass.

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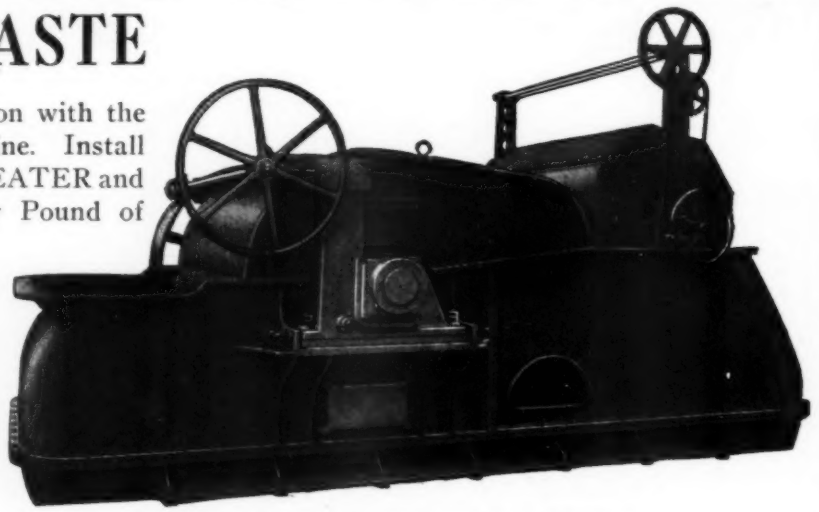

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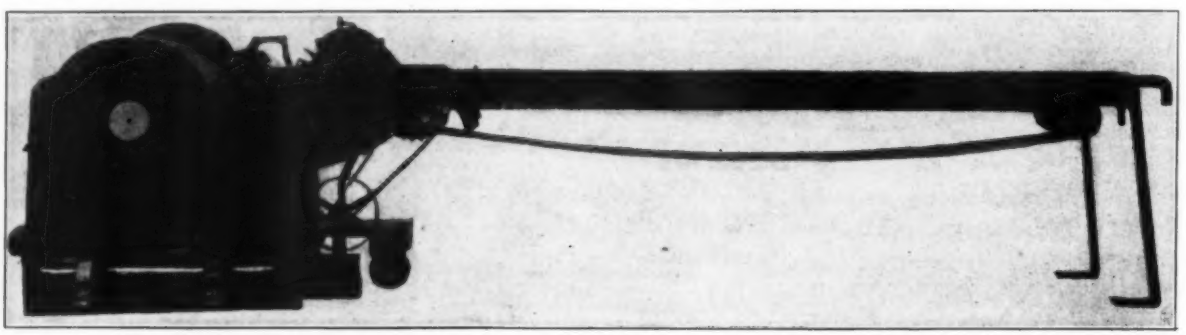

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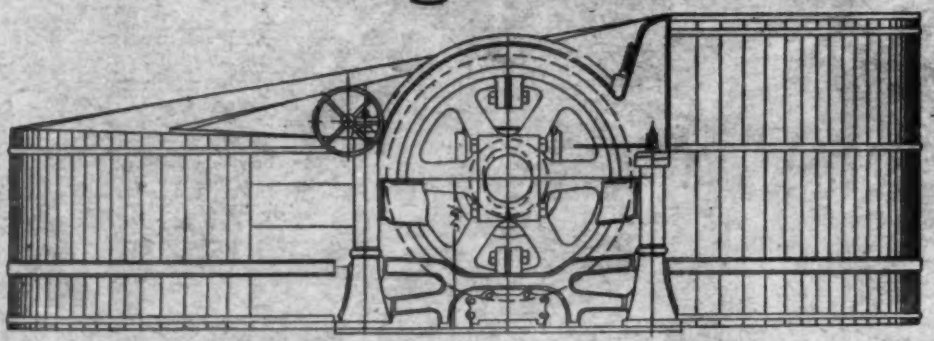

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